HISTORY

OF THE

COTTON MANUFACTURE

IN GREAT BRITAIN:

WITH A NOTICE OF ITS EARLY HISTORY IN THE EAST, AND IN ALL THE QUARTERS OF THE GLOBE;

A DESCRIPTION OF

THE GREAT MECHANICAL INVENTIONS,

WHICH HAVE CAUSED ITS UNEXAMPLED EXTENSION IN BRITAIN;

AND A VIEW OF THE

PRESENT STATE OF THE MANUFACTURE,

AND THE

CONDITION OF THE CLASSES ENGAGED IN ITS SEVERAL DEPARTMENTS.

BY EDWARD BAINES, JUN. ESQ.

EMBELLISHED AND ILLUSTRATED WITH

PORTRAITS OF INVENTORS, DRAWINGS OF MACHINERY, ETC.

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H. FISHER, R. FISHER, AND P. JACKSON.

TO THE

RIGHT HON. C. POULETT THOMSON, M.P.

THIS VOLUME IS INSCRIBED,

AS A TRIBUTE OF ADMIRATION

FOR THE EMINENT SERVICES HE HAS RENDERED

TO THE INTERESTS OF TRADE IN GENERAL,

AND TO THE COTTON MANUFACTURE IN PARTICULAR,

BY

HIS ABLE AND ENLIGHTENED ADVOCACY OF

Free Trade;

BY HIS MEASURES AS VICE-PRESIDENT AND

PRESIDENT OF THE BOARD OF TRADE,

IN REPEALING THE MISCHIEVOUS DUTY ON

COTTON PRINTS,

IN LOWERING THE TAXATION

ON MANY ARTICLES CONSUMED IN MANUFACTURES,

IN SIMPLIFYING AND CONSOLIDATING THE

Commercial Code,

AND IN

OPENING NEW MARKETS FOR BRITISH MANUFACTURES

ABROAD;

FOR WHICH SERVICES HE HAS BEEN

TWICE ELECTED TO REPRESENT THE TOWN OF

MANCHESTER,

THE METROPOLIS OF THE COTTON MANUFACTURE,

IN PARLIAMENT;

AND FOR WHICH

THIS MARK OF RESPECT IS PAID BY

THE AUTHOR.

PREFACE.

The history of civilization consists greatly in the history of the USEFUL ARTS. These arts form the basis of social improvement. By their means men are raised above abject want, become possessed of comforts and luxuries, and acquire the leisure necessary to cultivate the higher departments of knowledge. There is also an intimate connexion between the arts and natural science. Mutually aiding each other, they go hand in hand in the course of improvement. The manufactory, the laboratory, and the study of the natural philosopher, are in close practical conjunction. Without the aid of science, the arts would be contemptible: without practical application, science would consist only of barren theories, which men would have no motive to pursue.

These remarks apply with peculiar force to the arts by which clothing is produced, and, above all, to the Cotton Manufacture of England, which is the very creature of mechanical invention and chemical discovery, and which has, in its turn, rendered the most important service to science, as well as increased the wealth and power of the country.

The subject of this volume may therefore claim attention from the man of science and the political philosopher, as well as from the manufacturer and merchant. To trace the origin and progress of so great a manufacture, with the causes of that progress, is more worthy the pains of the student, than to make himself acquainted with the annals of

wars and dynasties, or with nineteen-twentieths of the matters which fill the pages of history.*

The Cotton Manufacture of England presents a spectacle unparalleled in the annals of industry, whether we regard the suddenness of its growth, the magnitude which it has attained, or the wonderful inventions to which its progress is to be ascribed. Within the memory of many now living, those machines have been brought into use, which have made as great a revolution in manufactures as the art of printing effected in literature. Within the same period, the Cotton Manufacture of this country has sprung up from insignificance, and has attained a greater extent than the manufactures of wool and linen combined, though these have existed for centuries.

Sixty years since, our manufacturers consumed little more than THREE million lbs. of raw cotton annually; the annual consumption is now TWO HUNDRED AND EIGHTY million lbs. In 1750 the county of Lancaster, the chief seat of the trade, had a population of only 297,400; in 1831, the number of its inhabitants had swelled to 1,336,854. A similar increase has taken place in Lanarkshire, the principal seat of the manufacture in Scotland. The families supported by this branch of industry are estimated to comprise A MILLION AND A HALF of individuals; and the goods produced not only furnish a large part of the clothing consumed in this kingdom, but supply nearly one-half of the immense export trade of Britain, find their way into all the markets of the world, and are even destroying in the Indian market the competition

* So thought Pliny, when he said—"Mira humani ingenii peste, sanguinem et cædes condere annalibus juvat, ut scelera hominum noscantur mundi ipsius ignaris."—*Plin. Hist. Nat.* l. ii. c. 9. Locke's opinion on the study of the useful arts was thus expressed—"There is a large field of knowledge, proper for the use and advantage of men in this world; viz. to find out new inventions of despatch, to shorten or ease our labour; or applying sagaciously together several agents and materials, to procure new and beneficial productions fit for our use, whereby our stock of riches, (i. e. things useful for the conveniences of our life,) may be increased, or better preserved."—*Lord King's Life of Locke*, 8vo. edition, vol. i. p. 163.

of the ancient manufacture of India itself, the native country of the raw material, and the earliest seat of the art.

The causes of this unexampled extension of manufacturing industry are to be found in a series of splendid inventions and discoveries, by the combined effect of which a spinner now produces as much yarn in a day, as by the old processes he could have produced in a year; and cloth, which formerly required six or eight months to bleach, is now bleached in a few hours.

It is the object of this volume to record the rise, progress, and present state of this great manufacture;—briefly to notice its ancient history in the East, and its sluggish and feeble progress in other countries, until the era of invention in England;—to point out the advantages of this country for manufacturing industry;—to state, more fully and accurately than has hitherto been done, the origin and authorship of the great mechanical inventions, including the *fly-shuttle*, the *spinning by rollers*, the *carding machine*, the *jenny*, the *mule*, the *steam-engine*, the *power-loom*, the *dressing-machine*, the *cylinder printing machine*, and *mechanical engraving*;—to mention the important chemical discoveries in the art of bleaching, and the various and beautiful processes of calico-printing;—to shew the combined effect of these inventions and discoveries, in the astonishing extension of the manufacture;—to give the natural history of the raw material, cotton-wool;—to show how far the trade has been interfered with by legislative enactments and fiscal regulations;—to describe and illustrate the present state of the manufacture, and the condition of the vast population engaged in its various departments;—and, finally, to weigh the probabilities in favour of, or against, the continued pre-eminence of the English Cotton Manufacture.

Thus extensive and interesting is the field which I have aspired to occupy. In the greater part of it I have had no predecessor. The want of a comprehensive and accurate history of the Cotton Manufacture has often been lamented, and has been justly considered discreditable to the literature

of the country which is the birth-place of so many admirable inventions, and where the most extraordinary branch of manufactures and commerce ever known has sprung up with marvellous rapidity.

In executing my task, I have received valuable assistance from gentlemen, who combine a thorough practical knowledge of the manufacture with the best information as to its history. I have been fortunate enough to meet with evidence as to the real authorship of the greatest inventions in cotton spinning, never before published, and as decisive as it is novel. I have also had the advantage of the evidence recently given before the Commission to inquire into the condition of children working in Factories, and before the Select Committees of the House of Commons on Manufactures, Commerce, and Shipping, and on Hand-loom Weavers; by which much light is cast on the actual state of the Cotton Manufacture, and on the condition of all classes of persons engaged in it. I have been favoured by the Factory Inspectors with a body of valuable statistical information, altogether original, shewing the number of cotton mills in each county, town, &c. of England, Scotland, and Ireland, with the number of operatives engaged in them, and the amount of steam and water power by which the mills are moved.

To the following gentlemen, I offer my grateful acknowledgments, for their kind assistance in obtaining the materials for this work; some of whom have bestowed an amount of time and pains in aiding my inquiries, which, as I had no claim to it on personal grounds, I must attribute to their zeal for the diffusion of knowledge:—The Right Hon. C. Poulett Thomson, M. P., late President of the Board of Trade; Geo. Richardson Porter, Esq., of the same office; John Kennedy, Esq., of Manchester; James Thomson, Esq. F. R. S., of Clitheroe; John Shuttleworth, Esq., Distributor of Stamps, Manchester; John Bowring, Esq. LL.D. and M. P.; Rd. Guest, Esq. of Leigh; Wm. Willock, Esq., Distributor of Stamps, Leeds; Sir Chas. Wilkins, Librarian of the East India Company; Thos. Thornely, Esq. M. P. of Liverpool;

Edward Strutt, Esq., M. P., of Derby; Dr. Cleland, of Glasgow; John Crosby, Esq. of Nottingham; J. Garnett, Esq. of "the Manchester Guardian;" Joseph Lockett, jun. Esq., of Manchester; and the four Factory Inspectors, Robert Rickards, Esq., Leonard Horner, Esq., Robert J. Saunders, Esq., and Thos. Jones Howell, Esq. Whenever I was in want of information, I repaired at once to the fountain-head in each department; and such were the courtesy and liberality of the gentlemen applied to, that in every case I received all the attention I could have desired.

An outline of the present work was published nearly two years since, in the "History of the County Palatine of Lancaster, by Edward Baines, Esq."—an extensive work in course of publication. I contributed this portion towards my father's History of the County where that manufacture chiefly flourishes. It was thought, however, by persons eminently qualified to judge, that the History of the Cotton Manufacture ought to be published in a separate volume, such a work being greatly needed. Among these, Mr. M'Culloch, in an article in No. 117 of the *Edinburgh Review*, having quoted from the work, referred to it in the following manner:—

> "See the excellent History of the Cotton Manufacture, by Mr. "Baines, jun. of Leeds, in the 'History of Lancashire.' We hope that "this valuable article may be detached from the work in which it "has appeared, and published separately."

I have complied with this suggestion; and, having bestowed much labour, not unsuccessfully, in obtaining additional materials to elucidate both the early history and the actual state of the manufacture, I am now enabled to present to the public a far more complete and more accurate portraiture of the largest and most extraordinary branch of manufacturing industry existing in the world. The work has swelled to nearly three times its original dimensions. I hope the interest has not been diminished, but increased, by the enlargement.

Leeds, January 28, 1835.

ORDER OF ENGRAVINGS.

WOOD CUTS.

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THE HISTORY

OF

THE COTTON MANUFACTURE.

CHAPTER I.

INTRODUCTION.

India the birth-place of the Cotton Manufacture.—England its second birth-place.—Early history and spread of the manufacture.—Effects of machinery.—Scanty materials for the history.—The principal materials of human clothing, cotton, flax, wool, and silk.—Cotton-wool, its appearance and qualities.—Its recommendations for clothing, compared with linen, both in hot and cold climates.

The birthplace of the Cotton Manufacture is India, where it probably flourished long before the date of authentic history. But so rude are the implements of the Indian spinner and weaver, that no people possessing a physical organization less exquisitely adapted to give manual dexterity than that of the Oriental, have been able to work cotton into a fine cloth by the same processes. The mechanical inventions which have enabled the western nations to compete with, and in some respects greatly to surpass the Hindoos, and which have suddenly given to the cotton manufacture an unparalleled extension in Europe and America, have had their origin in England, and within the last age. England, therefore, is the second birth-place of the art; and it is the principal object of this volume to record the origin, progress, and present state of this important branch of industry in our own country.

Before entering, however, upon the history of the manufacture in England, it will be proper to inquire into its ancient existence, and to trace its course from East to West;—not merely because this is a subject of natural and legitimate curiosity, and one which has been strangely neglected, but also because the result of the inquiry affords, by contrast, the strongest possible proof of the utility of machinery, and of the importance of those particular inventions which are afterwards to be described. It will be found that the manufacture of cotton was introduced into Europe at a comparatively late period, and existed there like a tropical plant in northern latitudes, degenerate and sickly, till, by the appliances of modern science and art, it suddenly shot forth in more than its native luxuriance, and is now rapidly overspreading the earth with its branches. Within one age, by the aid of machinery, the manufacture has made greater progress than it had previously made in many centuries.

Mechanical knowledge has taught man to substitute for the labour of his own hands, the potent and indefatigable agency of nature. The operations which he once *performed*, he now only *directs*. Iron, water, steam, all mechanical powers, and all chemical agents, are his faithful drudges, and not merely yield their mighty forces to his command, but execute works much more subtle and delicate than his own dexterity could accomplish. By this means, manufactures of every kind have undergone a transformation scarcely less important than that which takes place in the caterpillar, when it is changed from a creeping into a winged insect. The new power given to the cotton manufacture will be best appreciated, by contrasting with the lofty flight

it has recently taken, its crawling progress in all former times.

The review of the early history of the manufacture will necessarily be brief. No materials exist for making it otherwise. Whilst the writers of antiquity, both sacred and profane, abound in allusions to clothing made of wool and flax, there are scarcely a dozen sentences to be found in the whole body of Greek and Latin literature, and not one in Hebrew, referring to cotton. The reason is, that the growth and manufacture of cotton were confined to those populous regions lying beyond the Indus, which were an unknown world to the nations bordering on the Mediterranean. To come to later times;—the writers of the middle ages, and those who lived during the revival of arts and letters, in describing the progress of commerce, or the spoil of captured cities, or the garments of both sexes, continually mention stuffs of woollen, linen, silk, and gold, in all their varieties; but such a manufacture as that of cotton appears to have been unknown to them. Until modern times, therefore, nearly all the evidence is negative, with the exception of the reports brought by adventurous travellers, or gleaned by inquisitive naturalists.

Of the four great raw materials which furnish the clothing of men—cotton, flax, wool, and silk—the first two belong to the vegetable world, and the last two to the animal. Cotton, flax, and wool, having short and slender filaments, require to be spun into a thread before they can be woven into cloth; silk needs only that the threads spun by the worm should be twisted together, to give them the requisite strength.

Whilst the bounty of the Creator has furnished these

materials in inexhaustible abundance, his wisdom has given them in such forms as to exercise the industry and ingenuity of men in applying them to useful purposes, and in such situations as strongly to encourage the intercourse of different nations. Flax appears to have been indigenous in Egypt, and probably in other countries; the sheep is supposed to be a native of the mountainous ranges of Asia;* the silk-worm was given to China; and the cotton-plant to India and America.

Among all the materials which the skill of man converts into comfortable and elegant clothing, that which appears likely to be the most extensively useful, though it was the last to be generally diffused, is the beautiful produce of the cotton-plant. This material bears so much resemblance to the earlier-known article of sheep's wool, that among the ancients it was called the "*wool of trees*;" by the Germans it is called *baumwolle*, or *tree-wool*; and in our own language it bears the name of *cotton-wool*; though the properties of this vegetable substance differ greatly from those of the animal fleece. Cotton is a white substance, and in some of its varieties cream-coloured, or of a yellow hue; it possesses downy softness and warmth, and its delicate fibres are sufficiently long, flexible, and tenacious, to admit of being spun into an extremely fine thread. It grows upon the plant enclosed within pods, which protect it from injury by dust or weather, until it is ripe and fit to be gathered, when the heat of the sun causes it to expand, and burst open the pod.

The following is a drawing of the cotton pod and flower belonging to the Annual Herbaceous Cotton Plant, (*Gossypium Herbaceum*) —

* Cuvier's Animal Kingdom, vol. iv. p. 312.



The fibres of cotton are shewn, by the microscope, to be somewhat flat, and two-edged or triangular, and to be not straight but contorted;—a construction which causes the fibres to adhere to each other, and which gives warmth to cotton clothing. The fibres of flax, on the other hand, are straight tubes, with a smooth surface.

Cotton is produced both from annual plants and from trees, of which there are many varieties; and, under proper cultivation, it is raised in such abundance as to be the cheapest of all the materials of clothing.*

* The natural history of the cotton plant will be given in a subsequent chapter

The properties of cotton strongly recommend it for clothing, especially in comparison with linen, both in hot and cold countries. Linen has, indeed, in some respects, the advantage; it forms a smooth, firm, and beautiful cloth, and is very agreeable wear in temperate climates; but it is less comfortable than cotton, and less conducive to health, either in heat or in cold. Cotton, being a bad conductor of heat, as compared with linen, preserves the body at a more equable temperature. The functions of the skin, through the medium of perspiration, are the great means of maintaining the body at an equable temperature amidst the vicissitudes of the atmosphere. But linen, like all good conductors of heat, freely condenses the vapour of perspiration, and accumulates moisture upon the skin: the wetted linen becomes cold, chills the body, and checks perspiration, thus not only producing discomfort, but endangering health. Calico, on the other hand, like all bad conductors of heat, condenses little of the perspiration, but allows it to pass off in the form of vapour. Moreover, when the perspiration is so copious as to accumulate moisture, calico will absorb a greater quantity of that moisture than linen. It has therefore a double advantage,—it accumulates less moisture, and absorbs more.

From the above considerations, it is evident, that in cold climates, or in the nocturnal cold of tropical climates, cotton clothing is much better calculated to preserve the warmth of the body than linen. In hot climates, also, it is more conducive to health and comfort, by admitting of freer perspiration.*

* Another advantage of calico over linen has been mentioned to me by a scientific gentleman, as important; calico, being a worse conductor of electricity than linen, does not so easily allow the body to be deprived of its due supply of the electric fluid; and this, I am assured, has no small influence on the warmth and comfort of the body.

CHAPTER II.

EARLY HISTORY OF THE COTTON MANUFACTURE.

Spinning and Weaving invented at a very early period; known to the Egyptians in the time of Joseph.—Linen the national manufacture of Egypt; Cotton, that of India.—Antiquity of the cotton manufacture in India.—Testimony of Herodotus; of Nearchus, Arrian, and Strabo.—Growth and manufacture of cotton spread to Persia and Egypt.—Testimony of Pliny.—Curious etymology of *Cotton*.—Ancient commerce in Indian cottons.—Testimony of the Periplus.—Early excellence of the manufacture.—Indian cottons and muslins imported sparingly into Rome and Constantinople.—The use of silks much more rapidly extended than that of cottons.

THE arts of spinning and weaving, which rank next in importance to agriculture, having been found among almost all the nations of the old and new continents, even among those little removed from barbarism, are reasonably supposed to have been invented at a very early period of the world's history.* They evidently existed in Egypt in the time of Joseph, 1700 years before the Christian era, as it is recorded that Pharaoh "arrayed him in vestures of fine linen." (Genesis

* According to Pliny, Semiramis, the Assyrian queen, was believed to have been the inventress of the art of weaving. Minerva is in some of the ancient statues represented with a distaff, to intimate that she taught men the art of spinning; and this honour is given by the Egyptians to Isis, by the Mohammedans to a son of Japhet, by the Chinese to the consort of their emperor Yao, and by the Peruvians to Mamaoella, wife to Manco-Capac, their first sovereign. These traditions serve only to carry the invaluable arts of spinning and weaving up to an extremely remote period, long prior to that of authentic history.

xli. 42.)* Two centuries later, the Hebrews carried with them, on their departure from that ancient seat of civilization, the arts of weaving, spinning, dyeing, and embroidery; for when Moses constructed the tabernacle in the wilderness, "the women that were wise-hearted did spin with their hands, and brought that which they had spun, both of blue, and of purple, and of scarlet, and of fine linen." (Exod. xxxv. 25.) They also "spun goats' hair;" and Bezaleel and Aholiab "worked all manner of work, of the engraver, and of the cunning workman, and of the embroiderer, in blue, and in purple, and in scarlet, and in fine linen, and of the weaver." (35.) These passages contain the earliest *mention of woven clothing, which was linen, the national manufacture of Egypt.* The prolific borders of the Nile furnished from the remotest periods, as at the present time, abundance of the finest flax;† and it appears, from the testimony both of sacred and profane history, that linen continued to be almost the only kind of clothing used in Egypt till after the Christian era.‡ The Egyptians exported their "linen yarn," and "fine linen," to the kingdom of Israel, in the days of Solomon, (2 Chron. i. 16; Prov. vii. 16;) their "fine linen with broidered work," to Tyre, (Ezek. xxvii. 7;) and

* It is conjectured by the President de Goguet and other learned men, that the Hebrew word translated in our version, "fine linen," really signifies *cotton*. A passage in Herodotus, (book ii. chap. 93,) has also been understood as intimating that the Egyptians wrapped their mummies in *cotton* cloths. Both these conjectures seem to me destitute alike of proof and probability; but as the discussion would be too long for a note, I shall state the reasons for the conclusion I have come to in the Appendix, A.

† Paintings representing the gathering and preparation of flax have been found on the walls of the ancient sepulchres at Eleithias and Beni Hassan, in Upper Egypt, and are described and copied by Hamilton—"Remarks on several parts of Turkey, and on ancient and modern Egypt," pp. 97 and 287, plate 23.

‡ Herodotus, book ii. c. 37, 81.

the same kind of cloth to Greece, in the days of Herodotus.* They were still noted for their manufacture of linen, and their export of flax, under the Roman emperors.† Linen, in fact, continued to be the principal article of clothing worn by all the nations west of the Indus; and to the present day it is most extensively used in the East, and in every part of the world. The fleece of the sheep was probably one of the first materials made into cloth: wool is distinctly mentioned, along with linen, in the books of Moses and Solomon;‡ and though little used in the warm climate of Egypt, woollen garments were common in the cooler regions of Europe and Asia Minor. Manufactures both *of linen and woollen existed in Greece in the days* of Homer.

It is in the highest degree probable, that cotton was manufactured in India, as early as linen in Egypt. If the opinion is correct, that the arts of spinning and weaving were known to the founders of all the Eastern nations, the Indians would be quite as likely to make cloth of the woolly produce of their cotton plant, as the Egyptians of the fibrous bark of their flax. In the days of Herodotus, the father of history, who wrote about the year 445 B.C., it is evident that cotton was the customary wear of the Indians; for among the particulars which his keen and universal curiosity gleaned concerning that remote nation, he records, as one of the beautiful and wondrous things that distinguished them, —"They possess likewise *a kind of plant*, which,

* Herodotus, book iii. c. 105.

† Gibbon's Roman Empire, vol. 1, c. 10, p. 144, 8vo. edition.

‡ Deuteronomy xxii. 11.—"Thou shalt not wear a garment of divers sort, as of woollen and linen together." And Proverbs xxxi. 13.—"She seeketh wool and flax, and worketh willingly with her hands."

instead of fruit, produces *wool*, of a finer and better quality than that of sheep: *of this the Indians make their clothes*."* If, then, at that period, cottons were the common clothing of the people, it may with strong probability be inferred that they had been so for centuries, as the most striking characteristic of the Indians, arising out of the spirit of their institutions, has always been their extreme indisposition to change.† It should be remarked, that the Greek historian mentions this plant as peculiar to India. He gives no hint of a vegetable wool being made into clothing elsewhere. Of the Babylonians he says, distinctly, that their dress was of linen and of wool, (book i. c. 195;) and of the Egyptians, that their dress was only of linen, except that the priests wore a white woollen shawl when not engaged in their ministrations, (book ii. c. 37, 81.) It may therefore be concluded with certainty, that at this time the cotton manufacture prevailed generally in India, and also that it existed in no other country westward of the Indus.

We are led to the same conclusion by the statements of Nearchus, the admiral whom Alexander the Great employed (327 B.C.) to descend the Indus, and to navigate the coast of Persia to the river Tigris. From the interesting and obviously faithful narrative of this observant navigator, substantially preserved in Arrian's History of Alexander, we learn that, "the Indians wore linen garments, the substance whereof they were made *growing upon trees*; and this," he says, "is indeed

* Herodotus, book iii. c. 106.

† "In India, the manners, the customs, and the dress of the people are almost as permanent and invariable as the face of nature itself." —*Robertson's Historical Disquisition concerning Ancient India*, sect. I.

flax, or rather *something much whiter and finer than flax.* They wear shirts of the same, which reach down to the middle of their legs; and veils, which cover their head and a great part of their shoulders."* He likewise says, that the Indian name for the cotton tree was *tala*, and he describes its pods.† The accurate Strabo, in his account of the Indians, mentions, on the authority of Nearchus, their flowered cottons, or chintzes, (σινδόνας εὐανθεῖς;) and also celebrates the various and beautiful dyes with which their cloths were figured. This learned geographer states, that in his own day, (and he died A.D. 25,) "cotton grew, and cotton cloths were manufactured, in Susiana, a province of Persia, at the head of the Persian Gulf.‡

In the time of Pliny, who lived fifty years later than Strabo, the cotton plant was known in Upper Egypt, and also in the island of Tylos, in the Persian Gulf. He says—"In Upper Egypt, towards Arabia, there grows a shrub, which some call *gossypium*, and others *xylon*,§ from which the stuffs are made which we call *xylina*. It is small, and bears a fruit resembling the filbert, within which is a downy wool, which is spun into thread. There is nothing to be preferred to these stuffs for whiteness or softness: beautiful garments are made from them for the priests of Egypt."‖ In his description of the

* Arrian's Indian History, c. xvi

† Ibid. c. 7.

‡ Strabo, lib. xv.

§ *Gossypium* was the Latin name; *xylon* (ξύλον) the Greek. Julius Pollux, in his *Onomasticon*, vii. 17. also describes the cotton plant as growing in Egypt in his day, A.D. 186.

‖ Plin. Hist. Nat. lib. xix. c. 1. (Delph. Ed. c. 2.) "Superior pars Ægypti in Arabiam vergens gignit fruticem, quem aliqui gossypium vocant, plures xylon, et ideo lina inde facta, xylina. Parvus est, similemque barbatæ nucis defert fructum, cujus ex interiore bombyce lanugo netur, nec ulla sunt iis candore mollitiave præferenda. Vestes inde sacerdotibus Ægypti gratissimæ."

island of Tylos, the same writer, following the Greek naturalist, Theophrastus, enumerates among its remarkable productions "wool-bearing trees," with leaves exactly like those of the vine, but smaller; these trees, he says, "bear a fruit like a gourd, and of the size of a quince, which, bursting when it is ripe, displays a ball of downy wool, from which are made costly garments of a fabric resembling linen."* The original is as follows—"Ejusdem insulæ excelsiore suggestu lanigeræ arbores alio modo quàm Serum. His folia infœcunda: quæ, ni minora essent, vitium poterant videri. Ferunt cotonei mali amplitudine cucurbitas, quæ maturitate ruptæ ostendunt lanuginis pilas, ex quibus vestes pretioso linteo faciunt: arbores vocunt *gossympinos*."

This passage is not only valuable as containing an exact description of the cotton plant, but also curious as offering at least a plausible derivation of the word *cotton*. Pliny says, that the pod of the cotton plant was of the size of a *quince*, a small fruit of the pear *genus*; the Latin name of this fruit was *cotoneum malum*, or *cydonium*,† (κυδώνιον,) from Cydon, a city of Crete, from which the quince is said to have been first brought; and it is supposed by Dr. Vincent and others, that the resemblance in size, thus pointed out, led to the name, *cotoneum*, being applied to the wool-bearing plant and its produce.‡ There is, however, another point of resemblance between the quince and the *gossypium*, or cotton plant, which is more likely to have occasioned a transference of the name; one species of quince, the *maliforma*, has leaves

* Plin. Hist. Nat. lib. xii. c. 10.

† Plin. Hist. Nat. lib. xv. c. 11. "Mala quæ vocamus cotonea, et Græcè cydonia." Hence the Italian name for this fruit, *cotogna*; the French, *coin*; the English, quince; and the botanical name, *cydonia*.

‡ Dr. Vincent, Voy[illegible]chus, p. 13.

covered on the upper side with downy wool;* and this, according to the etymologist Skinner, who is followed by Johnson, led to the application of the name *cotoneum*† to cotton. It is possible that the name of one plant which bore wool, may have been given to another plant bearing wool, or rather to its produce, by persons ignorant of the very wide difference between the two; and Pliny's comparison of the cotton-pod to the quince may either have arisen from the resemblance having previously been pointed out, though on another ground, or it may have helped to cause the name of *cotoneum* to be given to the produce of the *gossypium*. It must be admitted, that if this is not the source of the word *cotton*, the verbal coincidences presented here are extremely remarkable. Yet, on the other side, it is extraordinary that the word should not have come down by the accustomed channels, the Latin or Greek, in which languages I am not aware that *cotoneum* was ever applied to cotton,‡—but by the very circuitous route of Arabia. Our word *cotton* is evidently derived from the Arabic قطن which, in European characters is *kotón*, and is pronounced *gootln*. Hence the

* Plin. Hist. Nat. lib. xv. c. 17. "Necnon aliqui in floccis capsisque, quas luto paleato illinunt."

† Skinner's *Etymologicon*, voc. "COTTON, a Fr. *Cotton*, Ital. *Cottone*, C. Br. *Cottam*, Lana Xylina. Sic autem dictum à similitudine lanuginis quæ adhæret malis cydoniis, quæ Ital. *Cotogni* appellantur. *Cotogni* autem a *Cydonio* manifestè ortum ducit."

‡ I have examined Facciolati's Lexicon, Salmasius' Exercitationes Plinianæ, &c. without finding any application of the word *cotoneum* to cotton. The earliest use of the word in a Latin form, applied to the substance cotton, which I have been able to discover, is in a charter of Roger, king of Sicily, dated A. D. 1145, in which mention is made of a former charter, dated A. D. 1102, and stated to be written on cotton paper ("*charta cuttunea*.") But as the Europeans both learned the art of making cotton paper from the Arabs, and received their cotton-wool from countries where the Arabic language was spoken, the word was probably adopted from them, and not found in the classical Latin.

Italians and the Spaniards, both of whom first received cotton and the cotton manufacture from the Arabs, took their names for the substance, the Italians calling it *cotone*,* and the Spaniards *algodon*, i. e. *godon*, with the article *al* prefixed.† From the Italian the name has been taken by the English and French, unless they also drew it direct from the Arabic, as they may have done during the crusades. But it is possible that the Arabs themselves may have adopted the word from the Latin or Greek, and thus it may have reached Europeans by this eccentric course. I confess myself unable to form a decided opinion on so nice a question of etymology.‡

The first mention of cottons as an article of trade, is in that valuable record of ancient commerce, "The Circumnavigation of the Erythræan Sea," (*Periplus Maris Erythræi*,) by Arrian, an Egyptian Greek, who lived in the first or second century of the Christian era. This writer, who was himself a merchant and a navigator, sailed round the coasts of the Erythræan Sea, which comprehends that part of the ocean from the Red Sea to the

* The Italians also call cotton *bambagio*, and the cotton tree *bambagio*, the origin of which word is doubtless correctly given by Montfaucon, in speaking of cotton paper:—"This paper is called in Greek χάρτης βομβύκινος, or βαμβάκινος, that is, cotton paper. For though βόμβυξ in Pliny, and some other writers, signifies silk, yet it means also cotton, especially in the later writers, as well as βάμβαξ, and therefore it is that the Italians still call cotton *bambacio*." *Montfaucon's Supplement to Antiquity Explained*, vol. iii. book iv. c. 5.—Pliny sometimes confounds together the natural history of silk and cotton, which is not to be wondered at, as he wrote by report concerning the productions of distant countries: he heard that both silk and cotton grew upon trees;—a report probably originating in the fact, that the silk-worm feeds on the leaves of the mulberry tree, which is cultivated for the sole purpose of raising silk.

† From the Arabs also Europeans adopted the under-garment now universally worn, the shirt, the Arabic name for which is *camees*, whence the Italian *camiscia*, and the French *chemise*.

‡ An Oriental scholar, whom I have consulted on the subject, offers the conjecture that the word may possibly have originated in the Chaldee word קִטְנִית (kitnith,) a *pod*, or seed vessel.

furthest extremity of India; and he particularly describes the imports and exports of several Indian towns, in their trade with the Arabs and Greeks. From this work it appears, that the Arab traders brought Indian cottons to Aduli, a port of the Red Sea; that the ports beyond the Red Sea had an established trade with Patala, (on the Indus,) Ariakè, and Barygaza, (the modern Baroche, on the great river Nerbuddah, near the north-western coast of India,) and received from them, among other things, cotton goods of various kinds; that Barygaza exported largely the calicoes, muslins, and other cottons, both plain and ornamented with flowers, made in the provinces of which this was the port, and in the interior and more remote provinces of India;* that Masalia (the modern Masulipatam) was then, as it has been ever since, famous for the manufacture of cotton piece goods;† and that the muslins of Bengal were then, as at the present day, superior to all others, and received from the Greeks the name of *Gangitiki*, indicating that they were made on the borders of the Ganges.‡

* Periplus, p. 28. The author also mentions Pŭthana, which is shown by Lieut. Wilford to be the modern Pultanah, on the southern bank of the Godavery, two hundred and seventeen miles south of Baroche; and Tagara, which is shown to be the modern Dowlatabad. The high grounds across which the author of the Periplus says that goods were conveyed from Tagara to Barygaza, are the Ballagaut mountains.—Asiatic Researches, vol. i. p. 369.

† Periplus, p. 35. Vincent, vol. ii. p. 523.

‡ "*Σινδόνες αἱ διαφορώταται, αἱ Γαγγιτικαὶ λεγόμεναι.*" The mention of the superiority of the Bengal muslins is a proof both of the accurate information contained in the Periplus, and of the wonderfully stationary condition in which the arts of India have remained, even as to their particular localities, from the date of the earliest records. The other names given in the Periplus to cotton goods, are *Καρπάσος*—fine muslins; *Μολόχινα*—coarse cottons; *Ὀθόνιον*—muslin; *Μοναχή*—wide muslins of the finest kind. *Χυδαῖον*—coarse muslins or cottons.—See Dr. Vincent's Periplus, Appendix, vol. ii. pp. 18, 58, 75, 76.—At the town of Baroche, in Guzerat, (mentioned in the text,) Forbes describes the manufacture as being now in nearly the same state, as when the Periplus was written. He says—"The cotton trade at Baroche is very considerable, and the manufactures of this valuable

From the evidence of Strabo, Pliny, and the Periplus, quoted above, it appears that the growth and manufacture of cotton had, at the Christian era, extended to Persia and Egypt; and also that the delicate fabrics of India, including muslins and calicoes, both plain and figured, were brought by Greek navigators to the ports of Egypt and Arabia, whence, it may be presumed, they would reach the capital of the Roman world, and some of the wealthy cities of Greece. Yet cotton goods could not have been imported into Rome or Greece to any considerable extent, or even regularly, since there is no distinct mention of them as articles of importation or consumption by any of the writers of those countries, though the other produce of the East, gold, spices, precious stones, and even silk, are often specified. The same conclusion is still more decisively drawn from the fact, that the various kinds of cotton goods are not enumerated in the Roman law *de Publicanis et Vectigalibus*,* which included the different articles of merchandise imported, with the duties chargeable upon them. But as a very extensive trading intercourse existed between Italy and Egypt, it is certain that cotton goods would have been imported into Italy if they had been

plant, from the finest muslin to the coarsest sail-cloth, employ thousands of men, women, and children, in the metropolis and the adjacent villages. The cotton clearers and spinners generally reside in the suburbs, or poorahs, of Baroche, which are very extensive. The weavers' houses are mostly near the shade of tamarind and mango trees, under which, at sun-rise, they fix their looms, and weave a variety of cotton cloth, with very fine baftas and muslins. Surat is more famous for its coloured chintzes and piece goods. The Baroche muslins are inferior to those of Bengal and Madras, nor do the painted chintzes of Guzerat equal those of the Coromandel coast."---Forbes's Oriental Memoirs, vol. ii. p. 222.

* Robertson's Disquisition on India, note xxv. Dr. Robertson is of opinion that the Romans imported the cotton piece-goods of India, but he says—"As far as I have observed, we have no authority that will justify us in stating the ancient importation of them to be in any degree considerable." sect. 2.

largely manufactured in Egypt. It is probable that the use of cotton clothing was introduced very slowly in that country, and did not become general for some centuries.

To those who have observed the rapid spread of the cotton manufacture in the present generation, it may appear beyond measure extraordinary that a branch of industry so apt to propagate itself should have lingered thirteen hundred years on the coast of the Mediterranean, before it crossed that sea into Greece or Italy. It may also appear remarkable, that the exquisite fabrics of India should not, when known, have been eagerly desired in the Roman empire, and been largely imported. Such was the case with silks, which, though more costly, and fetched from the more remote region of China, were sought with avidity by the ladies of Rome, and still more by those of the eastern capital, Constantinople. Silk, both raw and manufactured, became an important article of commerce through India and Persia, and even by the route of the Oxus, the Caspian, and the Volga: and it is justly commemorated as an important event, that silk-worms, with the art of manufacturing their produce, were brought from China to Constantinople, by two Persian monks, in the reign of Justinian, A.D. 552.* It appears that Indian cotton goods were imported into the Eastern empire in the same age, as they are found in the list of goods charged with duties in Justinian's digest of the laws;† but being scarcely mentioned by any

* Procopius, de Bello Gothico, lib. iv. c. 17.

† Navigantium atque Itinerantium Bibliotheca, or a complete Collection of Voyages and Travels; by John Harris, D.D. F.R.S. In an introductory account of the "Discovery, Settlement, and Commerce of the East Indies," the author says— "We find amongst the rest of the Indian commodities charged with duties (in the public laws of the empire, collected by Justinian,) all sorts of silk and cotton manufactures, which they brought, as we do, from those countries, and probably

writer, whilst silks are perpetually mentioned, it must be inferred that cottons were held in very subordinate estimation, and probably introduced only in small quantities. Left to conjecture to account for this fact, I can only suppose that the soft texture, glossy surface, and brilliant hues of silk, so different from woollen, linen, or cotton, and so much superior, captivated general admiration;* and that muslins and chintzes could not vie with silks as articles of luxury, whilst they were too dear to compete with the manufactures of wool and flax as the materials of ordinary wear.

for the same reason, because they found that method cheaper than bringing the commodity and working it up at home." vol. i. p. 506. It is evident that Dr. Harris wrote before the invention of the spinning machines in England. See also Vincent's Periplus of the Erythræan Sea, vol. ii. Appendix.

* Silk is the only material used for human clothing, which Mohammed introduces among the luxuries of Paradise. See the Koran, chap. 35.

CHAPTER III.

THE MANUFACTURE IN ASIA, AFRICA, AND AMERICA.

Introduction of cotton clothing in Arabia.—Spread of the manufacture by the Mohammedan conquests.—Known throughout western Asia in the middle ages.—Testimony of William de Rubruquis and Marco Polo.—Late introduction of the Cotton Manufacture in China;—its prevalence there.—Nankeens.—Japan and the Indian islands.—The growth and manufacture of cotton throughout Africa.—Cotton indigenous in America.—Beautiful fabrics of the Mexicans.—Cotton clothing worn by the natives in the West Indies and South America, on their discovery by Columbus.

In Arabia and the neighbouring countries, cottons and muslins came gradually into use; and the manufacture was spread, by the commercial activity and enterprise of the early followers of Mohammed, throughout the extended territories subdued by their arms. It is recorded of the fanatical Omar, the immediate successor of the Arabian impostor, that "he preached in a tattered cotton gown, torn in twelve places;" and of Ali, his contemporary, who assumed the caliphate after him, that "on the day of his inauguration, he went to the mosque dressed in a thin cotton gown, tied round him with a girdle, a coarse turban on his head, his slippers in one hand, and his bow in the other, instead of a walking staff."* From these circumstances we should infer, that cottons had then become, in every sense, an *ordinary* article of clothing in Arabia.

In that lively picture of Eastern manners, the "Arabian Nights' Entertainments," muslins are occasionally

* Crichton's History of Arabia, vol. i. pp. 397, 403.

mentioned; but it appears that the fabrics which first received the name of *muslins*, from being made at Mosul, in Mesopotamia, were not of cotton, or, at least, not exclusively so; as Marco Polo says—"All those *cloths of gold and silk*, which we call *muslins* (*mossoulini*,) are of the manufacture of Mosul."* It must not be supposed that cotton fabrics have at any time wholly superseded the use of linen in Mohammedan countries, or that they were esteemed as comparable in beauty with silks. Linen is still extensively used in Egypt and Arabia, as is shown by many passages in the works of Pococke, Niebuhr, and Burckhardt;† but it is also evident from the travels of Thevenot, Burckhardt, Hamilton, Buckingham, and many others, that cotton is the principal article of clothing even in those two countries, and still more in Syria, Mesopotamia, Persia, and Asia Minor.‡

From the travels of William de Rubruquis, a monk sent by Louis IX. as his ambassador to several courts of the East, in the year 1252, we learn that at that time cottons were articles both of trade and dress in the Crimea and southern Russia; they were brought from Turkistan. The same traveller informs us, that cotton cloths were worn in the southern provinces of Tartary, though by no means generally, and were imported from Persia, and other countries of the East.§

The interesting narrative of Marco Polo, the Vene-

* Travels of Marco Polo, translated by Wm. Marsden, F.R.S. book i. chap. 6.

† See Pococke's Description of the East, vol. i. p. 174. Burckhardt's Travels in Arabia, pp. 37, 38, 183, 184.

‡ Thevenot's Travels, in Harris's Collection, vol. ii. pp. 821, 895, &c. Burckhardt's Travels in Arabia, pp. 183, 184. Hamilton's Remarks on several parts of Turkey and Egypt, pp. 388, 127. Buckingham's Travels in Mesopotamia, vol. i. pp. 145, 291, 362; vol. ii. pp. 29, 37. (8vo. edit.)

§ Travels of William de Rubruquis, in Harris's Collection, vol. i. pp. 558, 560, 561: translated from Ramusio.

tian traveller, who visited nearly all the countries of Asia at the latter part of the thirteenth century, and who observed the dress of different nations with mercantile minuteness, enables us to trace pretty accurately the extent to which the manufacture had spread in that part of the globe. It appears that at that period there was a manufacture of very fine cotton cloth at Arzingan, in Armenia Major;* that cotton was abundantly grown and manufactured in Persia,† and all the provinces bordering on the Indus;‡ that in all parts of India this was the staple manufacture, and that it flourished particularly in Guzerat, Cambay, Bengal, Masulipatam, and Malabar.§ Polo also mentions that at Kue-lin-fu (Kienning-fu, in the province of Fokien,) in China, "cottons were woven of coloured threads, which were carried for sale to every part of the province of Manji."‖ But in no other place does he mention cotton as being grown or made into cloth in China, whilst he continually speaks of the inhabitants as being clothed in silks.

From this might be inferred the curious fact, established by the Chinese annals, that that early-civilized, ingenious, and industrious people, to whom the world is indebted for the important manufactures of silk, paper, and sugar, and who practised the art of printing, and knew the properties of the magnet and the composition

* Travels of Marco Polo, book i. c. 4.

† Ibid. book i. c. 6, 11, 29.

‡ Ibid. book i. c. 25. Polo says, that the women of Balashan (in Caubul) "wear below their waists, in the manner of drawers, a kind of garment, in the making of which they employ, according to their means, a hundred, eighty, or sixty ells of fine cotton cloth, which they also gather and plait, in order to increase the apparent size of their hips; those being accounted the most handsome who are the most bulky in that part."

§ Ibid. book iii. c. 21, 22, 28, 29, 31.

‖ Ibid. book ii. c. 74.

of gunpowder, before any other nation, should have remained without the cotton manufacture until the end of the thirteenth century, when it had flourished among their Indian neighbours probably three thousand years. It appears, indeed, from Chinese history, that the cotton plant had been known in the country for many centuries before that time, but that it had only been cultivated in gardens, and manufactured as a rarity. We learn from other authority, that in the ninth century the inhabitants, from the prince to the peasant, were clothed in silks.* The facility with which the plant is propagated, the commercial intercourse which existed from the earliest times between India and China, and the suitableness of cotton clothing to the climate, combine to render it wonderful that the manufacture should have been introduced at so late a period. The fact affords a powerful presumption, that China had long remained in a stationary condition. It was after the conquest of that empire by the Tartars, that the cotton plant first began to be cultivated for common use. A formidable resistance was made to the introduction of the new manufacture by the artisans engaged in fabricating woollens and silks: but in China, as elsewhere, the new art was found to be too valuable for its opponents to succeed in crushing it; the cheapness with which the raw material could be grown, and consequently the cloth fabricated, was an all-powerful recommendation; and about the year 1368 it triumphed over every resistance, and began to prevail throughout the empire.

* "Les Chinois s'habillent de soye durant l'hyver et durant l'esté. Cette maniere de s'habiller est commune aux princes, aux soldats, et à toutes les autres personnes de moindre qualité." –Anciennes Relations des Indes et de la Chine, de deux Voyageurs Mahometans, qui y allèrent dans le neuvième siecle; traduite d'Arabe par l'Abbé Renaudot, p. 16.

The cottons of China, especially the nankeens,* have attained considerable celebrity, though no improvement has been made on the rude and simple machines so long used in the manufacture in India. At the present time, as we are assured by Sir George Staunton, cottons, dyed of a blue colour, are universally worn by both sexes among the lower orders of the Chinese,† though the upper classes are still habited in silks. A

* It has been much disputed whether the *nankeens* are made from a cotton of their peculiar colour, or are dyed to that colour. Sir George Staunton, who travelled with Lord Macartney's embassy through the province of Kiangnan, to which province the nankeen cotton is peculiar, distinctly states, that the cotton is naturally "of the same yellow tinge which it preserves when spun and woven into cloth." He also says that the nankeen cotton degenerates when transplanted to any other province.—*Embassy to China,* by Sir George Staunton, vol. ii. p. 425.—Sir George Thomas Staunton (son of the above) has translated an extract from a Chinese Herbal, "on the character, culture, and uses of the annual herbaceous cotton plant," in which the plant producing "dusky yellow cotton," of very fine quality, is mentioned as one of the varieties.—*Narrative of the Chinese Embassy to the Khan of the Tartars,* p. 252.—Van Braam, who travelled in China with a Dutch embassy at the close of the last century, and who had been commissioned by European merchants to request that the nankeens for their markets might be dyed of a deeper colour than those last received, says—"La toile de Nam-king, qu'on fabrique fort loin du lieu du même nom, est faite d'un coton *roussâtre:* la couleur de la toile de Nam-king est donc naturelle, et point sujette à pâlir."—Voyage de l'Ambassade de la Compagne des Indes Orientales Hollandaises, vers l'Empereur de la Chine, vol. i. p. 322.—A modern navigator says, "Each family (at Woosung) appears to cultivate a small portion of ground with cotton, which I here saw of a light yellow colour. The nankeen cloth made from that requires no dye."—Voyage of the ship Amherst to the N. E. coast of China, 1832: published by Order of the House of Commons, p. 80.—A nankeen-coloured cotton grows at Puraniya (Purneah,) near the banks of the Ganges, in India, and is mentioned by Dr. F. Hamilton, in an unpublished account of that district, in the library of the India House in London. A similar cotton grows in small quantities in the southern states of the American Union, as I learn from Mr. G. R. Porter's "Tropical Agriculturist," and from M. Malte Brun, vol. v. p. 193. The colour of the cotton seems to depend on some peculiarity in the soil.

† Sir George Staunton's Embassy to China, vol. ii. p. 380.—The same testimony is borne by the Catholic missionary, Fernandez Navarette, who wrote in the latter part of the seventeenth century, and who says—"It is prodigious what a quantity of coarse, finer, and most delicate cotton webs there are in China, and all very lasting."—Collection of Voyages, edited by Locke, vol. i. chap. xiv.

sufficient quantity of cotton is not grown within the empire for the home consumption, and large importations are regularly made from Surat, Bombay, and other parts of India.* In the empire of Japan,† in Java, Borneo, and the numberless islands of the Indian and Chinese archipelagoes, cotton is the ordinary apparel of the natives.

The growth of the cotton plant and the manufacture of its wool were spread, probably by the Mohammedans, at an early period, into every part of the continent of Africa north of the equator. In the year 1590, cotton cloth, of native manufacture, was brought to London from Benin, on the coast of Guinea.‡ Many centuries before, the manufacture had flourished greatly in Morocco and Fez.§ Modern travellers in central and western Africa represent the cotton plant or tree as growing plentifully on the borders of the Senegal, the Gambia, and the Niger, at Timbuctoo, Sierra Leone, in the Cape

* From Bengal alone the export of cotton to China averages fifty thousand bales per annum; but much of this cotton comes originally from Surat and Bombay. The following is an official return, presented to the Committee of the House of Commons in 1832, of the quantity of cotton shipped at the port of Calcutta for China:—

Years.	Bales.	Maunds.
1823-4	31,874	115,960
1824-5	54,793	199,324
1825-6	48,250	177,266
1826-7	83,131	314,052
1827-8	55,074	197,590
1828-9	50,815	185,029
1829-30	———	126,613

The average of the seven years is 187,976 maunds per annum, which, at 80lbs. per maund, is 15,038,080lbs. The exports from the presidency of Bombay to China are stated to be 40,000,000lbs. per annum.

† Macpherson's Annals of Commerce, vol. ii. p. 108.

‡ Ibid. vol. ii. p. 193.

§ De Marlès Hist. de la Domination des Maures en Espagne, tom. i. p. 468. Ramusio's Viaggi, tom. i. p. 30.

de Verd islands, on the coast of Guinea, in Abyssinia, and throughout the interior; and the barbarous or semi-barbarous natives, as being every where clothed in their own cotton manufactures, often dyed and figured, and sometimes interwoven with silk, and of exquisite workmanship.*

Cotton, indeed, as has already been shewn, is, of all the materials of clothing, best suited to the torrid zone. In hot climates, likewise, the cotton plant grows so abundantly, that this is the cheapest material of which cloth can be made. With such recommendations, it cannot fail to continue the staple and universal manufacture of Africa.

Before coming to the introduction of the cotton manufacture into Europe, it may be well to mention, that it was found existing in considerable perfection in America, on the discovery of that continent by the Spaniards. Cotton formed the principal article of clothing among the Mexicans, as they had neither wool, hemp, nor silk; nor did they use the flax which they possessed for purposes of clothing;† and their only materials for making cloth, besides cotton, were feathers, the wool of rabbits and hares, (known in commerce as coneys' wool,) and the fibrous plant called the *maguei*.

We are informed by the Abbé Clavigero, that "of cotton the Mexicans made large webs, and as delicate and fine as those of Holland, which were with much

* See the Travels of Mungo Park, p. 17; Réné Caillié, vol. i. p. 426; vol. ii. pp 62, 63, 67; Richard and John Lander, vol. i. pp. 32, 90, 91, vol. ii. pp. 3, 4, 316. Histoire Générale des Voyages, vol. x. liv. 7. pp. 282, 228; vol. xii. liv. 9. p. 471. Bruce's Travels to the Source of the Nile, book vi. c. 19; book vii. c. 5. Clapperton's Second Expedition, p. 57.

† Clavigero's Hist. of Mexico, book i. sect. 7.

reason highly esteemed in Europe. They wove their cloths of different figures and colours, representing different animals and flowers. Of feathers interwoven with cotton, they made mantles and bed curtains, carpets, gowns, and other things, not less soft than beautiful. With cotton also they interwove the finest hair of the belly of rabbits and hares, after having made and spun it into thread: of this they made most beautiful cloths, and in particular winter waistcoats for the lords."* Among the presents sent by Cortes, the conqueror of Mexico, to Charles V., were "cotton mantles, some all white, others mixed with white and black, or red, green, yellow, and blue; waistcoats, handkerchiefs, counterpanes, tapestries, and carpets of cotton;" and "the colours of the cotton were extremely fine,"† as the Mexicans had both indigo and cochineal among their native dyes. They also used cotton in making a species of paper;‡ one of their kinds of money consisted in small cloths of cotton;§ and their warriors wore cuirasses of cotton, covering the body from the neck to the waist.||

Columbus also found the cotton plant growing wild, and in great abundance, in Hispaniola, and other West India islands, and on the continent of South America, where the inhabitants wore cotton dresses, and made their fishing nets of the same material;** and when

* Clavigero's History of Mexico, book vii. sect. 57, 66.
† Ibid. book vii. sect. 58.
‡ Humboldt's Researches, vol. i. p. 162.
§ Clavigero, book vii. sect. 36.
|| Humboldt, vol. i. p. 202.
** Sommario dell' Indie Occidentali del S. Don Pietro Martire, in Ramusio's Collection, tom. ii. pp. 2, 4, 16, 50.

Magellan went out on his circumnavigation of the globe, in 1519, the Brazilians were accustomed to make their beds of this vegetable down.*

It can scarcely be doubted that the cotton and indigo plants are indigenous in America,† as well as in India; but the arts of spinning and weaving were probably carried over by the wanderers, whoever they may have been, by whom that continent was first peopled. The manufacture of cotton must therefore be supposed to be coeval with the original settlement of America; but learned men are much divided as to the date of this event,—some carrying it nearly as high as the deluge,‡ and others contending for a much later period. The American manufacture may, at all events, claim a high degree of antiquity

* Vicentino's Viaggio atorno il Mondo, (with Ferd. Magellan,) in Ramusio, tom i. p. 353.

† "Cotton was found among the indigenous productions of Mexico at the time of the conquest, and furnished almost the only clothing used by the natives. The cultivation has since been much neglected, and the art of imparting to it the brilliant colours so common among the Aztecs, entirely lost. In the *tierra caliente* of Mexico, the cotton-tree propagates itself." Ward's Mexico in 1827, vol. i. pp. 79, 80. The native American cotton is therefore produced from the tree, not from the annual herbaceous plant.

‡ This is the opinion of the Abbé Clavigero. Dr. Robertson offers no opinion on the subject, owing to its extreme difficulty.

CHAPTER IV.

THE MANUFACTURE IN EUROPE.

The Cotton Manufacture introduced late into Europe.—First introduced by the Moors into Spain, in the tenth century.—Flourished in Andalusia; in Catalonia.—Cotton Paper.—The Cotton Manufacture introduced into Italy, in the fourteenth century.—Never flourished in that country.—Carried on in Flanders and Germany.—Much cotton grown and manufactured in Turkey.

HAVING thus noticed the existence and progress of the cotton manufacture in three quarters of the globe, Asia, Africa, and America, I am now to shew its introduction into Europe, where, though its entrance was later than in the other three, it has received, from the inventive genius of Englishmen, a new and nobler existence. In Asia, the spirit of invention, so early developed, has lain nearly dormant for thousands of years; the rich soil has degenerated into poverty, from the perpetual sameness of the crops raised upon it; whilst the intellect of Europe, as though invigorated by the fallow of centuries, has received the seeds of Oriental arts and sciences, and brought them to far higher perfection than their native earth.

It is customary to look to Italy as the country where the arts, sciences, and manufactures first reappeared after the night of the middle ages, and from whence

they were diffused to the rest of Europe. Most of the European nations unquestionably owe this debt to the Italians. Yet it was neither in Italy nor Greece that the European cotton manufacture had its rise. We search the records of commerce in Christendom from the tenth to the fourteenth century, without finding a trace of this branch of industry, till we arrive at the latter period, and then only the faintest marks of its existence. Descriptions remain of the flourishing manufactures of silk, woollen, and linen, in Greece, in the tenth century;* of the silk manufactures of Sicily, Lucca, Venice, and other parts of Italy, in the twelfth, thirteenth, and fourteenth centuries; of the great extent and perfection of the woollen manufacture in Flanders, Lombardy, Tuscany, and Romagna, at the same periods;† and of the extensive trade carried on by the Italian states, the Hanse towns, Flanders, and France, on the revival of commerce and the arts. But in the records of all these branches of industry in different parts of Christendom, the manufacture of cotton finds no place.

In Spain, however, where science, letters, and every

* Legatio Liutprandi ad Nicephorum Phocam, in Muratori's Scriptores Rerum Italicarum, vol. iii. part 1. Gibbon's Roman Empire, c. liii.

† Denina, Rivoluzioni d'Italia, lib. xii. c. 6; and lib. xiv. c. 11. It is remarkable that this writer, who gives a particular account of the introduction, progress, and extent of the silk and woollen manufactures in various parts of Italy, and of other branches of industry, does not in his whole work mention the cotton manufacture, from which it may be safely inferred that that manufacture never rose to any considerable extent or reputation in that country. See also the very learned review of the commerce of the middle ages, in Robertson's Hist. Disq. on India, sect. iii. where many of the early writers collected by Muratori are quoted; Hallam's Europe during the Middle Ages, c. ix. part 2; Macpherson's Annals of Commerce, vol. 1; and Sismondi's Republiques Italiennes. All these works contain accounts of the woollen, silk, and linen manufactures at the period in question, but I have examined them in vain for any notice of the cotton.

kind of industry, flourished under the dominion of the Mohammedan caliphs whilst the rest of Europe was involved in intellectual darkness, we find that the cotton plant was cultivated, and its produce was manufactured into clothing, at least as early as the tenth century. In the reign of Abderahman III., justly styled the Great, who ruled in Cordova from 912 to 961, A. D. many of the natural productions and arts of the East were introduced, and those which had been previously introduced were cultivated to the highest point. The cotton plant, the sugar cane, rice, and the silk worm were naturalized; and the first flourished on the fertile plains of Valencia, where it still grows wild in these days of Spanish degeneracy.* Manufactures of every kind were carried on at Cordova, Granada, and Seville, as successfully as in the Eastern seats of Mohammedan splendour, Bagdad and Damascus.

Masdeu says, "Our fabrics of wool, linen, cotton, and silk were greatly esteemed throughout Europe, as is evident from the numerous articles of clothing which went from Spain to Rome in the ninth century, and from the cloth which the king Mahomad Abu Abdalla sent as a present to Charles the Bald, king of France, in the year 865, A. D."† This passage is somewhat ambiguous; it does not distinctly assert, though it seems to imply, that each of the manufactures mentioned existed in Spain in the ninth century. De

* The cotton plant, or rather the cotton tree, was chiefly cultivated at Oliva and Gandia. History of the Mahometan Empire in Spain, by Professor Shakspeare and the Rev. T. Hartwell Horne, p. 263.—"En Valencia, (says a modern naturalist,) vi muchos *algodoneros*, y no concibo por qué poi no se cultiva en España esta planta tan útil, como se cultivó en otros tiempos." Introduccion a la Historia Natural de España, por D. Gul. Bowles, p. 225.

† "Historia Critica de España," tom. xiii. p. 131.

Marlès positively states that the cotton manufacture was introduced by the Moors in the reign of Abderahman III., in the tenth century: he says, "The Moors, who were mingled with the Arabs, or who came to settle after the conquest—those whom the protection of Abderahman attracted thither—expert, ingenious, and active, introduced their manufactures, and taught the Spaniards many things of which they were before ignorant. The Moors excelled in the arts of tanning and preparing leather, of weaving cotton, linen, and hemp, and, above all, in the manufacture of silk stuffs. The Arabs devoted themselves more particularly to the manufacture of woollen cloth, and that of arms." "It was the Moors who brought into Spain the cultivation of rice and cotton, of the mulberry tree and the sugar cane."*

Abu Zacaria Ebn el Awam, a native of Seville, who wrote in the twelfth century his "Libro de Agricultura," which gained him the title of "prince of rustic economy," gives a very full account of the mode of culture proper for the cotton plant. He also states, that the plant was cultivated in Sicily, which island had been in the possession of the Saracens from the ninth to the eleventh century.† In the fourteenth century the manufacture of cotton was in a state of great perfection and prevalence in Granada, as the Spanish-Arabic historian of that kingdom, Ebn Alkhatib, declares in his description of the country:—"Here you find also the

* De Marlès "Histoire de la Domination des Arabes et des Maures en Espagne, redigée sur l'Histoire traduite de l'Arabe en Espagnol, de M. Joseph Condè," tom. i. pp. 468, 469.

† Libro de Agricultura, de Abu Zacaria Ebn el Awam, traducido por Don J. A Banqueri, tom. ii. c. xxii. p. 103.

coccus, with which the cotton stuffs are dyed; for there is a great abundance of cotton, as well for commerce as for use in manufactures; and the cotton garments made here are said to be far superior to those of Assyria, in softness, delicacy, and beauty."*

Notwithstanding the repugnance between the Moorish and Christian inhabitants of Spain, and the indisposition of the latter to receive any thing from the former, (most strikingly illustrated by the fact that the silk manufacture, which flourished in Andalusia in the *tenth* century, was not known in Catalonia till the *fifteenth*,) we find the celebrated commercial city of Barcelona had early received the cotton manufacture, which had become one of its most flourishing branches of industry in the middle of the thirteenth century. Capmany, the historian of the commerce of Barcelona, informs us that "among the various trades which anciently distinguished Barcelona, one of the most famous and most useful was that of the cotton manufacturers, who were an incorporated company from the thirteenth century, and gave name to two separate streets, *cotoners vells* and *cotoners nous,* which still preserve the memory of the ancient demarcation of their workshops. These artisans prepared and spun the cotton, for the weaving of various stuffs used in those times, and principally for the manufacture of cotton sail-cloth, which was always a very considerable branch of industry in a mercantile city, that for more than five hundred years was the station of the Spanish squadrons *(armadas.)*"† Again—"The

* Casiri—Bibliotheca Arabico-Hispana Escurialensis, tom. ii. p. 248.

† Capmany—"Memorias Historicas sobre la Marina, Comercio, y Artes de la antigua ciudad de Barcelona," tom. i. part iii. p. 25.

trade known by the name of fustian manufacturers, (*fustaneros,*) that is, weavers of cotton goods, was so ancient in Barcelona, that, in the year 1255, Veguér, on the representation of the municipal magistrate, owing to the annoyance caused by the vicinity of the dyers and embroiderers of those manufactures, ordained that no person should exercise the said trade except in the extremities and suburbs of the city." "The company consisted of weavers, dyers, and embroiderers."* And the historian proceeds to enumerate many minute regulations as to the kinds of goods they were allowed to make, the width, quality, &c. of the pieces, from which our English legislation on the woollen manufacture might have been implicitly copied. It appears, however, that in Barcelona, the cotton goods made were chiefly sail-cloth and fustians,—the latter being a strong fabric used to line garments, and which derives its name from the Spanish word *fuste*, signifying "substance."†

The Spanish Arabs made paper of cotton, before that most useful article was known in any other part of Europe. Paper was first made by the Chinese, of waste silk; the Saracens acquired the art on their capture of Samarcand, in the seventh century; and by them the manufacture of paper, from the cheaper and better material of cotton, was introduced into Spain, probably soon after the conquest of that country, and was carried on at Salibah. But the Spanish Arabs, finding linen to be still cheaper and better than cotton for this purpose, made paper of linen at Xativa, the modern San Felipe, in the kingdom

* Capmany, tom. i. part iii. p. 50.

† "*Fuste*, so called because it is as the *substance* of cloth or silk, which they line with it."—Diccionario de la Real Acad. Espan.

of Valencia, and the fabric was celebrated in the twelfth century; though, according to Tiraboschi, linen paper was first invented in Italy, in the middle of the fourteenth!*

The arts and civilization of Mohammedan Spain did not, however, spread to Christian Europe. Extensive as was the commerce of Andalusia, it was all with Africa and the East. Between the Mussulmans and the Christians there was as great a repugnance as between oil and water. Reciprocal hatred and scorn, and, not less, the ignorance and poverty of the Christian nations, formed insurmountable bars to intercourse. Even the Spanish Christians, as we have seen, learnt little from the invaders with whom they were for eight centuries in fierce contention; and when at length the Mohammedans were expelled, their arts disappeared with them, or remained in as ruinous a state as their castles and mosques. Instead of an inland sea, the Atlantic might have rolled between the Spanish and Italian peninsulas, so little did the latter receive from the former. Venice, Genoa, and Pisa carried on nearly all their foreign commerce with Greece, Constantinople, and the Syrian and Phœnician towns conquered by the Crusaders; and thus the Italians received from the East, arts which had long flourished in Spain.

The earliest date at which I have been able to discover

* [illegible] be found of [illegible] Roger, King of Sicily, in 1145, mentioned [illegible] Library at Paris with the date of 10[illegible] [illegible]

the existence of the cotton manufacture in Italy, is the beginning of the fourteenth century, which is assigned by a historian of Venetian commerce as the period of its introduction into Venice.* There is strong reason to believe, as has already been argued, from the silence of Denina and other historians, that the manufacture never attained any reputation, or considerable extent, in Italy. Cottons of a strong and heavy fabric, as fustians and dimities, were made at Venice and Milan; and it is probable that even those were woven, as afterwards in England, with linen warp and cotton weft; or that they were made entirely of cotton yarn imported from Syria and Asia Minor, whence the Italians and French in later times regularly drew supplies of that article.

In Hakluyt's Collection of Voyages there is a curious old poem, entitled, "The Processe of the Libel of English Policie," originally published in 1430, in which fustians are mentioned as an article of export from Flanders to Spain, and even of import into Flanders from the Easterlings, Prussia, and Germany. The following passages will amuse [illegible]

[illegible]

Of the commodities of Prussia, the High Dutch, and the Easterlings, the author enumerates

[illegible]

* [illegible] Dissertazione [illegible] Venez[illegible] [illegible] Denina [illegible] Histoire de [illegible] [illegible]

> And Colleyne threed, *Fustian*, and Canuas,
> Card, bukeram: of olde time thus it was."*

The names by which the fustians imported into England were known—*Jen fustians*, *Augsburg fustians*, and *Milan fustians*, which Dr. Fuller, who wrote in 1662, calls "their *old* names,"†—shew that the manufacture existed in Saxony and Suabia, as well as in Italy, at an early period. The use of this article existed in England even at an earlier date than the above. Our own poet, Chaucer, who wrote between 1370 and 1380, clothes his knight in it:—

> "Of *Fustian* he wered a Gipon,
> All besmotrid with his Habergion."
>
> *Prologue to the Canterbury Tales*

On this Dr. Fuller remarks, that fustians "anciently were creditable wearing in England for persons of the primest quality," and that "they were all foreign commodities."

Guicciardini, in his Description of the Low Countries in the year 1560, mentions that Antwerp imported from Venice "the finest and richest wrought silks, camblets, grograms, carpets, *cottons*, and great variety of merceries;" and from Milan "gold and silver thread, various wrought silks, gold stuffs, *fustians*, and *dimities of many fine sorts*; scarlets, tammies, and other fine and curious draperies." Here the dimities are said to be "of many fine sorts," yet this article itself is a rather strong fabric, and its fine qualities are not comparable in delicacy to many other kinds of cotton goods. "Venetian fustians" are among the articles enumerated as *exported* by the English Society of Merchants Adventurers in 1615; and the low export duty fixed on them, 3d. per piece, would lead us to conclude that their value must have been small, as the rates of export duty at the same time on English

* Hakluyt's Voyages, vol. i. p. 20 , 213, edition of 1809.
† Fuller's Worthies of England, vol. i. p. 537, edit. 1811.

woollens were as high as 2s. to 4s. 6d. per piece.*— From Guicciardini we learn that Antwerp imported from Germany "such a quantity of *fustians* as amounted to six hundred thousand crowns a year;" and exported to the north of Europe "spices, drugs, saffron, sugar, salt, English and Netherland cloths and stuffs, *fustians*, linens, wrought silks, gold stuffs, grograms, camblets, tapestries," &c.; and to England, amongst other things, cottons and cotton-wool, the latter of which the merchants of Antwerp brought from Portugal and other countries. In enumerating the various kinds of cloth made at different towns in the Low Countries, Guicciardini only twice makes mention of a cotton fabric, namely, fustians, which were manufactured "in great quantities" at Bruges, and also at Ghent.† This same article appears in a list of foreign goods, imported by the English Society of Merchants Adventurers, in 1601., from Holland and Germany,‡ and it is said to be of the manufacture of Nuremburgh. Guicciardini asserts, that fustians were first made in Flanders; but he gives no date, so that it is difficult to judge of the probable correctness of his assertion. The fact is not probable, though the Flemings, during the crusades, received many arts, and a great stimulus to industry, commerce, and luxury, from their intercourse with Syria, and they may in this manner have obtained the cotton manufacture. But it has been shewn that fustians were made extensively in Barcelona in the thirteenth century, and that their name indicates a Spanish origin.

* I state these facts on the authority of a pamphlet published in 1615, and which I have seen in the British Museum.

† Descrittione di tutti i Paesi Bassi, p. 408, 401. edition of 1581.

‡ A Treatise of Commerce; by John Wheeler, Secretary of the Society of Merchants Adventurers. (1601.) p. 23.

I have not been able to ascertain at what time cotton began to be manufactured in Turkey in Europe; but there seems no reason to think that it was before the conquests of the Turks in Romania, in the fourteenth century; nor could it be much after, as the victorious settlers would naturally bring with them their own arts, and the use of cotton garments was then common in Asia Minor. The cotton plant found a congenial soil and climate in Romania and Macedonia,* where it is now cultivated to a great extent; and the spinning and weaving of the wool forms one of the most important branches of industry in that country.†

* "The district of Seres (in Macedonia) is more fruitful in cotton than any other. The value of this article in Macedonia alone amounts to 7,000,000 of piasters."—Malte Brun's Geography, vol. vi. p. 156.

† "La Romanie s'occupe principalement de la filature du coton." Encyclopedie Methodique.—"On evalue la récolte du coton dans les Etats du Grand Seigneur (Asiatic as well as European) à cent mille balles, dont les nations suivantes n'en levent que douze mille, savoir—Les Francois 4500, les Hollandais 3500, les Anglois 2000, les Venitiens et Italiens 2000. Les quartre-vingt huit mille balles de surplus sont consommées par les manufactures de Turquie même."—Encycl. Method.

CHAPTER V.

SUMMARY OF THE EARLY HISTORY.

Slow extension of the Cotton Manufacture, and its low state in Europe.—Owing to the defectiveness of the machines and tools.—No improvement made in any country till the age of invention in England.—The distaff.—The spinning wheel.—The loom.—Cotton more difficult to spin than linen.—Great mechanical inventions in England.—The want of any history of those inventions.—This work an attempt to supply it.

The spread of the Cotton Manufacture has thus been traced, from its native seat in India, across the breadth of the old continent, to Japan eastward, and the mouths of the Tagus and the Senegal westward; and the use of cotton clothing has been shewn to have prevailed in America before the discovery of that continent by Europeans. If the progress of this branch of industry is faintly marked, I believe it must be ascribed rather to the extreme scantiness of the materials furnished by history, than to want of diligence in the search made for them.*

The inquiry yields some clear and satisfactory conclusions.

It is obvious that the use of cotton clothing spread very slowly, except when it was borne onward by the

* In this search I have had no predecessor; I am not aware, at least, that any account, even of the most meagre kind, has before been written of the early history of the Cotton Manufacture. The preceding sketch, as will be seen, is drawn from a great variety of unconnected sources.

impetuous tide of Mohammedan conquest and colonization. The manufacture was general in India, and had attained high excellence, in the age of the first Greek historian, that is, in the fifth century before Christ, at which time it had already existed for an unknown period; yet eighteen centuries more elapsed before it was introduced into Italy or Constantinople, or even secured a footing in the neighbouring empire of China. Though so well suited to hot climates, cottons were known rather as a curiosity than as a common article of dress in Egypt and Persia, in the first century of the Christian era, five centuries after the Greeks had heard of the "wool-bearing trees" of India: in Egypt the manufacture has never reached any considerable degree of excellence, and the muslins worn by the higher classes have always been imported from India. In Spain the manufacture, after flourishing to some degree, became nearly extinct. In Italy, Germany, and Flanders, it had a lingering and ignoble existence. It would be altogether a mistake to suppose that the same manufacture ever existed in any other part of Europe, which now exists in England. A coarse and heavy article was indeed fabricated, probably half of cotton and half of linen; but it was of too little importance to attract the notice of historians; and calicoes, muslins, and the more delicate cotton goods were never made in Europe, except possibly by the Moors in the south of Spain, until the invention of the spinning machinery in England.

The next fact worthy of observation is, that during the lengthened period which has been under review, no material improvement took place, in any country, in the implements by which cotton was spun and woven. The instrument used for spinning in all countries, from the

earliest times, was the distaff and spindle. This simple apparatus was put by the Greek mythologists into the hands of Minerva and the Parcæ; Solomon employs upon it the industry of the virtuous woman; to the present day the distaff is used in India, Egypt, and other countries; its early use in France is attested by its being figuratively mentioned in one of the old constitutional maxims of the kingdom;* and our own poets often introduce it in speaking of the occupations of women. Montfaucon gives a figure of a female spinning with the distaff, which, he says, is of the fourth or fifth century,† and of which the following is a copy:—



* "*Le royaume de France ne tombe point en* QUENOUILLE"—"the crown of France never falls to the *distaff*," i.e. never descends to a *woman*." Dryden alludes to this saying in the lines—

"See my royal master murder'd,
His crown usurp'd, a *distaff* in the throne."

† Antiquity Explained, vol. iii. part ii. book v. c. 8: the plate is in p. 219 of that volume.

The only advance made in this department was in changing the distaff for the one-thread spinning wheel, which has long been used in India for the coarse qualities of thread, and which has also obtained in China and in all European countries. But the wheel is an instrument not much more expeditious than the distaff, and therefore it does not greatly cheapen the article produced.

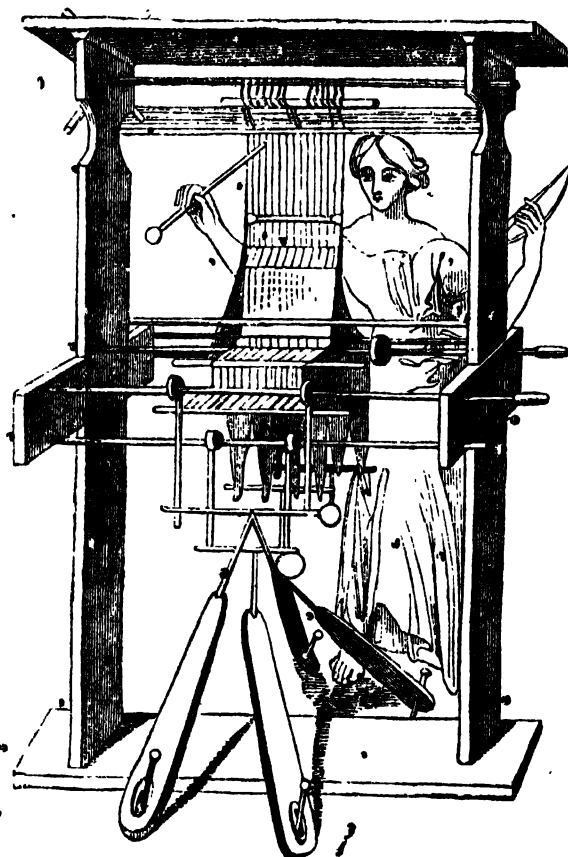
The apparatus for weaving underwent as little improvement as that for spinning.

The Indian loom will be described, and illustrated by a drawing, in the next chapter. That machine was probably in the same state four thousand years ago as at the present day: it contains all that is absolutely essential to the weaving of cloth, but put together in a rude, loose, and slovenly manner, and with the coarsest workmanship. The woollen loom was probably always more strongly made than the cotton loom, and there are slight differences in the mode of working among different nations; as, for example, we learn from Herodotus, that "the Egyptians shoot the woof beneath, and other nations above;"* and the Indians sit at their work, whilst the old custom in Europe, as shown by a drawing of the fourth century, was for the weaver to stand. But the loom used up to the eighteenth century contained scarcely any essential improvement on the ancient Indian loom, though it was constructed with greater firmness, neatness, and compactness. In Montfaucon's "Antiquity Explained"† there are two figures of females weaving in a standing posture; they are taken from the illuminations of books, which the learned antiquarian pronounces to be of the date of the fourth or

* Book ii. c. 35.

† Vol. iii. p. 219, 225.

fifth century. One of these figures is engraved below; the frame-work of the loom differs little from that of the modern hand-loom.



The loom used in this country at the beginning of the eighteenth century was a more perfect machine, but upon the same principle as the ancient loom; a principle of admirable ingenuity, yet susceptible, as has of late been practically shewn, of very great improvement, especially in respect to the quantity of work produced.

When the two facts above mentioned, namely, the slow progress of the manufacture, and the absence of any material improvement in the machines employed,

are viewed together, it appears highly probable that the former was the effect of the latter. But when we observe the sudden and marvellous extension of the trade *since* the invention of the spinning machines, not only in England, but throughout Europe and in the United States, there cannot remain a doubt that that which so long impeded the progress of the Cotton Manufacture was, the rudeness and tediousness of the modes of working. The cost of the raw material, in countries where the cotton plant did not grow, was unquestionably another hinderance; for the transport of so bulky an article, when there were not the present contrivances for compressing it, and when navigation was much more tedious and hazardous, must have been expensive. These two causes, but the first far more than the second, effectually prevented the manufacture from attaining to any degree of importance in Europe. From their combined effect, cotton yarn was considerably dearer than linen yarn. At the same time, it was greatly inferior in tenacity; because cotton, from having a shorter, feebler, and more elastic fibre than flax, needs to be much more firmly twisted, in order to make a strong thread. Owing to the imperfection of the spinning machine, therefore, it was impossible, at least for Europeans, to make cotton yarn combining strength with fineness. The yarn, when spun fine, was loose and flimsy; it could not be made strong, without being heavy.

The conclusion we have arrived at imparts great interest to the inquiry which is to be conducted in the following pages. For several thousand years no improvement was made in the art of fabricating cotton-wool into cloth. The art was in consequence depressed,

and extended itself sluggishly. A brilliant series of mechanical inventions, made during the last age, so economized labour, as to enable one man to do the work of a hundred. By this revolution in its processes the manufacture received an astonishing impulse, and in a single age eclipsed the greatest phenomena in the annals of commerce. These inventions were made in England; and they form at once the most splendid triumph of science applied to the useful arts, and an abundant source of wealth to the nation. It is not extravagant to say, that the experiments of the humble mechanist have in their results added more to the power of England, than all the colonies ever acquired by her arms.

To trace the origin of these inventions, then, must be an inquiry of national interest. What could be more discreditable to the literature of the country, than that it should fail to preserve a record of such high achievements in science and art,—of so great a boon to the world and to posterity? Yet the age in which they were actually made, has passed over without even an attempt to perform this duty. The inventors themselves were too busy, and too unaccustomed to the use of the pen, to commemorate the fruits of their genius; and the writers of the day were unconscious of the great revolution in industry that was silently proceeding. The very few authors who have since touched upon the subject, finding the materials so scanty, have compiled brief and most unsatisfactory notices, containing many serious errors. They have given exaggerated praise to some individuals concerned in the improvements, whilst the real authors of the most important inventions have been absolutely unknown to them, and therefore unnoticed. To repair this injustice, and to write, as fairly as the

materials allow, this striking page in the annals of our national industry, is the intent of the present work.

But before proceeding to the English manufacture, it will be right to devote a single chapter to some brief notice of the cotton manufacture in the country where it originated, and where the fabrics have so long maintained an unrivalled celebrity. This will be proper, not only because the subject is one of considerable curiosity, but also because the past and present state of the manufacture in India furnishes important points of comparison, or rather of contrast, with the past and present state of the same manufacture in England. The commercial history of the two is also connected. Nor can it be a matter of trivial interest to the inhabitants of this country to know the state of a branch of industry which is almost universal in our vast Eastern dependencies, and which, after having flourished for three or four thousand years in unapproached excellence, is now withering under the competition of a manufacture as matchless in the rapidity of its growth, as that of India has been singular in the length of its duration.

CHAPTER VI.

THE COTTON MANUFACTURE OF INDIA.

Unrivalled excellence of Indian muslins.—Testimony of ancient Mohammedan travellers, of Marco Polo, Barbosa, Frederick, Tavernier, and Rev. W. Ward. —Dacca muslins.—Specimen brought by Sir Charles Wilkins; compared with English muslins.—Decline of the manufacture of Dacca muslins; accounted for.—Indian cotton, both annual and perennial.—Its defects, owing chiefly to negligent cultivation and imperfect cleaning.—Evidence on the subject before Parliamentary Committees.—Processes of the manufacture in India.—Rude Implements.—Roller gin.—Bow.—Spinning wheel.—Spinning without wheel. —Loom.—Mode of Weaving.—Habits and remuneration of spinners, weavers, &c.—Factories of the East India Company.—Marvellous skill of the Indian workmen accounted for; their physical organization, training, &c.—Principal cotton fabrics of India, and where made.—Indian commerce in cotton goods.—Extensive importations into England in the 17th century.—Alarm created by them in English woollen and silk manufacturers.—Extracts from publications of the day.—Indian fabrics prohibited in England and most other countries of Europe.—Surprising commercial revolution caused by English machinery.—Proved by a petition from Calcutta merchants.—Extract from M. Dupin on English and Indian cotton manufactures.

THE antiquity of the cotton manufacture in India has already been noticed, and all that is known of it in classical times has been stated in the brief quotations from Herodotus, Arrian, Strabo, Pliny, and the Periplus. The present chapter will give some account of the remarkable excellence of the Indian fabrics,—the processes and machines by which they are wrought,—the condition of the population engaged in this department of industry,—the extensive commerce formerly carried on in these productions to every quarter of the globe,—and the decisive check given to that commerce by the manufactures of England.

The Indians have in all ages maintained an unapproached and almost incredible perfection in their fabrics of cotton. Some of their muslins might be thought the work of fairies, or of insects, rather than of men; but these are produced in small quantities, and have seldom been exported. In the same province from which the ancient Greeks obtained the finest muslins then known, namely, the province of Bengal, these astonishing fabrics are manufactured to the present day.

We learn from two Arabian travellers of the ninth century, that "in this country (India) they make garments of such extraordinary perfection, that no where else are the like to be seen. These garments are for the most part round, and wove to that degree of fineness that they may be drawn through a ring of moderate size."* Marco Polo, in the thirteenth century, mentions the coast of Coromandel, and especially Masulipatam, as producing "the finest and most beautiful cottons that are to be found in any part of the world;"† and this is still the case as to the flowered and glazed cottons, called chintzes, though the muslins of the Coromandel coast are inferior to those of Bengal.

Odoardo Barbosa, one of the Portuguese adventurers who visited India immediately after the discovery of the passage by the Cape of Good Hope, celebrates "the great quantities of cotton cloths admirably painted, also some white and some striped, held in the highest estimation," which were made in Bengal.‡ Cæsar Frederick, a Venetian merchant, who travelled in India in

* Anciennes Relations des Indes et de la Chine, de deux Voyageurs Mahometans, qui y allerent dans le neuviéme siecle, p. 21.

† Travels of Marco Polo, book iii. c. 21, 28.

‡ Ramusio's "Raccolto delle Navigationi et Viaggi," tom. i. p. 315.

1563, and whose narrative is translated by Hakluyt, describes the extensive traffic carried on between St. Thomé (a port 150 miles from Negapatam) and Pegu, in "*bumbast* (cotton) cloth of every sort, painted, which is a rare thing, because this kind of clothes shew as they were gilded with divers colours, and the more they be washed, the livelier the colours will shew; and there is made such accompt of this kinde of cloth, that a small bale of it will cost 1000 or 2000 duckets."*

Tavernier, who, like Marco Polo, Barbosa, and Frederick, was a merchant as well as a traveller, and therefore accustomed to judge of the qualities of goods, and who travelled in the middle of the seventeenth century, says —"The white calicuts," (calicoes, or rather muslins, so called from the great commercial city of Calicut, whence the Portuguese and Dutch first brought them) "are woven in several places in Bengal and Mogulistan, and are carried to Raioxsary and Baroche to be whitened, because of the large meadows and plenty of lemons that grow thereabouts; for they are never so white as they should be till they are dipped in lemon-water. Some calicuts are made so fine, *you can hardly feel them in your hand*, and the thread, when spun, is *scarce discernible*."† The same writer says, "There is made at Seconge (in the province of Malwa) "a sort of calicut so fine that when a man puts it on, *his skin shall appear as plainly through it, as if he was quite naked*; but the merchants are not permitted to transport it, for the governor is obliged to send it all to the Great Mogul's seraglio and the principal lords of

* Hakluyt's Voyages, vol. ii. p. 366. Edition of 1809.

† Tavernier's Travels, contained in Dr. Harris's Collection of Voyages and Travels, vol. i. p. 811.

the court, to make the sultanesses and noblemen's wives shifts and garments for the hot weather; and the king and the lords take great pleasure to behold them in these shifts, and see them dance with nothing else upon them."* Speaking of the turbans of the Mohammedan Indians, Tavernier says, "The rich have them of so fine cloth, that twenty-five or thirty ells of it put into a turban will not weigh four ounces."†

An English writer, at the end of the seventeenth century, in a remonstrance against the admission of India muslins, for which, he says, the high price of thirty shillings a yard was paid, unintentionally compliments the delicacy of the fabric by stigmatizing it as "only the *shadow* of a commodity."‡

The late Rev. William Ward, a missionary at Serampore, informs us that "at Shantee-pooru and Dhaka, muslins are made which sell at a hundred rupees a piece. The ingenuity of the Hindoos in this branch of manufacture is wonderful. Persons with whom I have conversed on this subject say, that at two places in Bengal, Sonar-ga and Vikrum-pooru, muslins are made by a few families so exceedingly fine, that four months are required to weave one piece, which sells at four or five hundred rupees. *When this muslin is laid on the grass, and the dew has fallen upon it, it is no longer discernible.*"§

After such statements as the above, from sober and creditable witnesses, the Oriental hyperbole which designates the Dacca muslins as "*webs of woven wind,*" seems only moderately poetical.

* Ibid. vol. i. p. 829. † Ibid. vol. i. p. 833.

‡ The Naked Truth, in an Essay upon Trade, p. 11.

§ View of the History, Literature, and Mythology of the Hindoos, by William Ward; vol. iii. p. 127. 3d edition.

I have been favoured by sir Charles Wilkins, the learned librarian of the East India Company, with a specimen of Dacca muslin, brought by himself from India in the year 1786, and presented to him by the principal of the Company's factory at Dacca, as the finest then made there. Like all Indian muslins, it has a yellowish hue, caused by imperfect bleaching. Though the worse for many years' exposure in a glass case, and the handling of visiters, it is of exquisite delicacy, softness, and transparency; yet the yarn of which it is woven, and of which sir Charles also brought a specimen, is not so fine as some which has been spun by machines in this country. The following minute, made by sir Joseph Banks on a portion of this yarn, twenty or thirty years since, appears at the India House in his own writing, together with a specimen of the muslin:—

"*The portion of skein which Mr. Wilkins gave to me weighed* 34$\frac{3}{10}$ *grains: its length was* 5 *yards* 7 *inches, and it consisted of* 196 *threads. Consequently, its whole length was* 1018 *yards and* 7 *inches. This, with a small allowance for fractions, gives* 29 *yards to a grain,* 203,000 *to a pound averdupoise of* 7000 *grains; that is,* 115 *miles,* 2 *furlongs, and* 60 *yards.*"

Cotton yarn has been spun in England, making three hundred and fifty hanks to the lb. weight, each hank measuring 840 yards, and the whole forming a thread of 167 miles in length. This, however, must be regarded merely as showing how fine the cotton can possibly be spun by our machines, since no such yarn is or could be used in the making of muslins, or for any other purpose, in this country. The extreme of fineness to which yarns for muslins are ever spun in England is 250 hanks to the lb., which would form a thread measur-

ing $119\frac{1}{3}$ miles; but it is very rarely indeed that finer yarn is used than 220 hanks to the lb., which is less fine than the specimen of Dacca muslin above mentioned. The Indian hand-spun yarn is softer than the mule-yarn of England, and the muslins made of the former are much more durable than those made of the latter. In point of appearance, however, the book-muslin of Glasgow is very superior to the Indian muslin, not only because it is better bleached, but because it is more evenly woven, and from yarn of uniform thickness, whereas the threads in the Indian fabric vary considerably.

It is probable that the specimen brought by sir Charles Wilkins, though the finest then made at the city of Dacca, is not equal to the most delicate muslins made in that neighbourhood in former times, or even in the present. The place called by the Rev. Mr. Ward Sonar-ga, and, by Mr. Walter Hamilton, Soonergong, a decayed city near Dacca, has been said to be unrivalled in its muslins. Mr. Ward's testimony has been quoted above. Mr. Ralph Fitch, an English traveller, in 1583, spoke of the same place when he said—"Sinnergan is a towne sixe leagues from Serrapore, where there is the best and finest cloth made of cotton that is in all India."* Mr. Hamilton says—"Soonergong is now dwindled down to an inconsiderable village. By Abul Fazel, in 1582, it is celebrated for the manufacture of a beautiful cloth, named *cassas* (cossaes,) and the fabrics it still produces justify to the present generation its ancient renown."† But it seems that there has been a great decline in the manufacture of the finest

* Hakluyt's Voyages, vol. ii. p. 390; edit. 1809.

† A Geographical, Statistical, and Historical Description of Hindostan, by Walter Hamilton, Esq. vol. i. p. 187—(1820.)

muslins, which is both stated and accounted for by Mr. Hamilton in the following passage on the district of Dacca Jelulpoor:—

"Plain muslins, distinguished by different names, according to the fineness or closeness of the texture, as well as flowered, striped, or chequered muslins, are fabricated chiefly in this district, where a species of cotton named the banga grows, necessary, although not of a very superior quality, to form the stripes of the finest muslins, for which the city of Dacca has been so long celebrated. The northern parts of Benares, furnish both plain and flowered muslins, which are not ill-adapted for common use, though incapable of sustaining any competition with the beautiful and inimitable fabrics of Dacca.

"The export of the above staple articles has much decreased, and the art of manufacturing some of the finest species of muslins is in danger of being lost, the orders for them being so few that many of the families who possess by hereditary instruction the art of fabricating them have desisted, on account of the difficulty they afterwards experience in disposing of them. This decline may partly be accounted for from the utter stagnation of demand in the upper provinces since the downfall of the imperial government, prior to which these delicate and beautiful fabrics were in such estimation, not only at the court of Delhi, but among all classes of the high nobility in India, as to render it difficult to supply the demand. Among more recent causes also may be adduced the French revolution, the degree of perfection to which this peculiar manufacture has lately been brought in Great Britain, the great diminution in the Company's investment, and the advance in the price of cotton."

With respect to the peculiar species of cotton of which the Dacca muslins are made, the following statement was given to a committee of the House of Commons, in 1830-31, by Mr. John Crawfurd, for many years in the service of the East India Company, and author of the "History of the Indian Archipelago:"—

"There is a fine variety of cotton in the neighbourhood of Dacca, from which I have reason to believe the fine muslins of Dacca are produced, and probably to the accidental discovery of it is to be attributed the rise of this singular manufacture; it is cultivated by the natives alone, not at all known in the English market, nor, as far as I am aware, in that of Calcutta. Its growth extends about forty miles along the banks of the Megna, and about three miles inland. I consulted Mr. Colebrook respecting the Dacca cotton, and had an opportunity of perusing the manuscripts of the late Dr. Roxburgh, which contain an account of it; he calls it a variety of the common herbaceous annual cotton of India, and states that it is longer in the staple, and affords the material from which the Dacca muslins have been always made."

India produces several varieties of cotton, both of the herbaceous and the tree kinds. Marco Polo mentions that "cotton is produced (in Guzerat) in large "quantities from a tree that is about six yards in height, "and bears during twenty years; but the cotton taken "from trees of this age is not adapted for spinning, "but only quilting. Such, on the contrary, as is taken "from trees of twelve years old, is suitable for muslins "and other manufactures of extraordinary fineness."* Sir John Mandeville, on the other hand, who travelled in the fourteenth century, fifty years later than Polo, mentions the annual herbaceous cotton as cultivated in India: he says—"In many places the seed of the cot-"ton, (cothon,) which we call tree-wool, is sown every "year, and there spring up from it copses of low shrubs, on which this wool grows."† Forbes also, in his Oriental Memoirs, thus describes the herbaceous cotton of Guzerat:—"The cotton shrub, which grows to the

* Book iii, chap. 29.

† Hakluyt's Voyages, vol. ii. p. 169.

"height of three or four feet, and in verdure resembles "the currant bush, requires a longer time than rice "(which grows up and is reaped in three months) to "bring its delicate produce to perfection. The shrubs "are planted between the rows of rice, but do not im-"pede its growth, or prevent its being reaped. Soon "after the rice harvest is over, the cotton bushes put "forth a beautiful yellow flower, with a crimson eye in "each petal; this is succeeded by a green pod, filled "with a white stringy pulp; the pod turns brown and "hard as it ripens, and then separates into two or three "divisions containing the cotton. A luxuriant field, "exhibiting at the same time the expanding blossom, "the bursting capsule, and the snowy flakes of ripe "cotton, is one of the most beautiful objects in the agri-"culture of Hindostan."*

The following general statement concerning the cotton of India, is from the geographical work of Malte Brun :—" The cotton tree grows on all the Indian "mountains, but its produce is coarse in quality : the "herbaceous cotton prospers chiefly in Bengal and on "the Coromandel coast, and there the best cotton goods "are manufactured. Next to these two provinces, Ma-"duré, Marawar, Pescaria, and the coast of Malabar, "produce the finest cotton."† He elsewhere says— "Cotton is cultivated in every part of India: the finest "grows in the light rocky soil of Guzerat, Bengal, "Oude, and Agra. The cultivation of this plant is "very lucrative, an acre producing about nine quintals "of cotton in the year."‡

* Forbes's Oriental Memoirs, vol. ii. p. 405.

† Malte Brun, vol. iii. p. 30.

‡ Ibid. vol. iii. p 303.

The cotton of India is generally inferior in quality, and still more in condition when brought to market, to the cotton of North and South America: but this, in the opinion of botanists who have had experience of Indian agriculture and soils, and in that of other attentive observers, is almost entirely owing to the neglect of the cultivators, who, from want of capital, and still more from constitutional indolence and apathy, omit to change the seed sow it in the most careless manner, take little care of the rising crop, gather it so that the cotton is made dirty, separate it from the seeds by the rudest machinery, and pack it for a distant market in such a manner that it comes to hand foul, oily, and mouldy.*

* The evidence given before the parliamentary committees on Indian affairs establishes all these points. The following is extracted from a digest of the evidence taken by the Lords' committee, in 1830:—"Indian cotton is usually at two-thirds the price of American of the same staple; it is shorter stapled than the short-stapled American. It is inferior, from the use of the native seed, and from its dirty state. Some of the best Surat cotton is nearly as good in quality as Georgia, but it is forty per cent. worse in price, from the American being better grown and cleaner. Very clean Indian cotton would approach nearly to the price of American. It is very possible to improve the growth of cotton in India, by improved cultivation and selection of seed. Bombay cotton might be grown as good as Sea Island." A digest of the evidence in the Commons' reports of 1830, 1830-1, and 1831, yields the following statements:—"Cotton is not sown in drills as in America, but broad-cast; there is no care taken of it afterwards, except to keep the cattle out of it. The cotton plant at Bombay is almost entirely an annual, a green seed, and short stapled. The ordinary cottons cultivated are for the most part the coarsest, because they are the most easy to rear; the finer varieties are very rare, because the people have not skill to keep them up; they are, in fact, delicate plants in comparison. The Indian cotton is short in the fibre, and strong in the staple, coarse, and always very dirty." The evidence received by the Commons' committee in 1832 informs us that "the cotton of India is bad, but from experiments lately made, there is no doubt that if good seed were procured, beautiful cotton might be produced abundantly (Mackenzie, Bracken, Wallick.) The failure of the natives in producing superior cotton is not so much to be attributed to their want of skill, as to that extraordinary feature in their character, that they will not do that at a greater advance of capital, or with greater

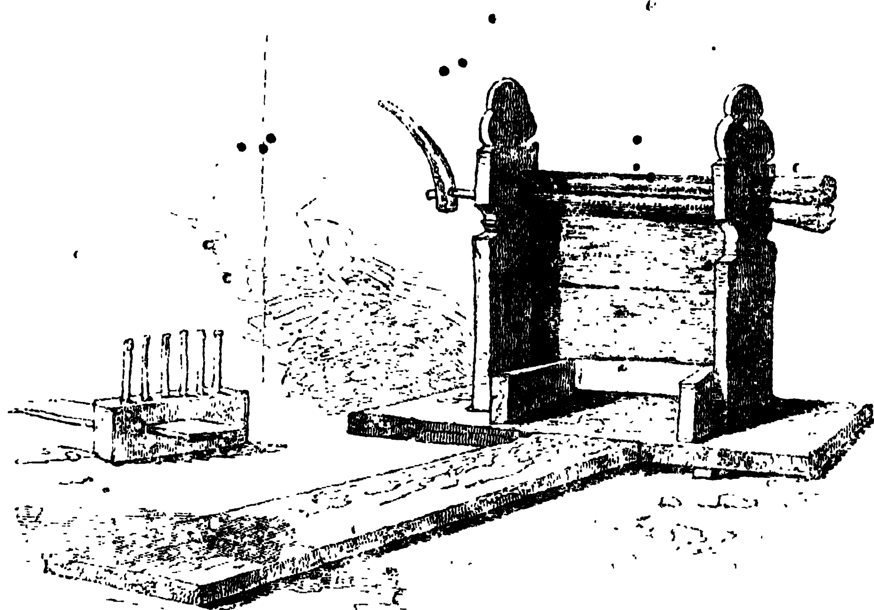
The cotton manufacture in India is not carried on in a few large towns, or in one or two districts; it is universal. The growth of cotton is nearly as general as the growth of food; every where the women spend a portion of their time in spinning; and almost every village contains its weavers, and supplies its own inhabitants with the scanty clothing they require.* Being a

exertion, which would give them a better return, if they can get it for less trouble by the use of less capital: they are the most improvident of the whole human race in this respect. India produces of itself every variety of cotton. The justly celebrated Sea Island cotton is actually in cultivation in several places in India, but owing to the manner of husbandry among the natives, it very soon loses all its principal characters for goodness, and returns to the quality of the original wild species. Proximity to the sea appears to be a necessary condition for continuing the excellence of cotton, but the miserable husbandry is quite sufficient to deteriorate any cotton. That brought home is extremely foul. From the manner in which the cotton is cleaned, parts of the oily substance of the seed are allowed to remain in; that not only discolours the cotton, but gives it a peculiar liability to become mouldy. It is conveyed to Calcutta in badly constructed boats, without any sufficient protection from the weather; and after lying on board four or five months, it arrives, as might be expected, in a dirty and filthy state. It is then put into cotton screws, which are not worked in a proper manner, and is subjected to an unequal pressure. With a quantity of seed screwed in it, and in the state of dampness and mouldiness in which it is imported into Calcutta, it is sent on board ship for England. It is impossible that the finest cotton could, under such treatment, arrive here in better state than the Bengal cottons do."

Dr. Wallick, the superintendent of the botanical garden at Calcutta, gives the following encouraging statement in a letter to the Hon. H. George Tucker, Esq. dated 12th October, 1828:—"That there is a sort of cotton, the produce of the West Indies, rather of Barbadoes, which has been cultivated with complete success in the Company's territories, I can assert with confidence, because I am in possession of an extract of a general commercial letter from the court, transmitted to me officially from the board of trade at Calcutta, in which it is pronounced equal, if not superior, to any kind procurable in the London market. I cultivated it in the garden at Tittyghecr, near Borrackpore, during several years in which that establishment continued attached to the botanic garden at Calcutta." Dr. W. adds, that in asserting the high capabilities of the Company's territories for the growth of the finest cotton, "*experience*, and not theory, is the ground on which he has proceeded."

* Orme, in his Historical Fragments of the Mogul Empire, says, "On the coast of Coromandel and in the province of Bengal, when at some distance from the high road or a principal town, it is difficult to find a village in which every man,

domestic manufacture, and carried on with the rudest and cheapest apparatus, it requires neither capital, nor mills, nor an assemblage of various trades. The cotton is separated from the seeds by a small rude hand-mill, or gin, turned by women, of which the following is a representation:—

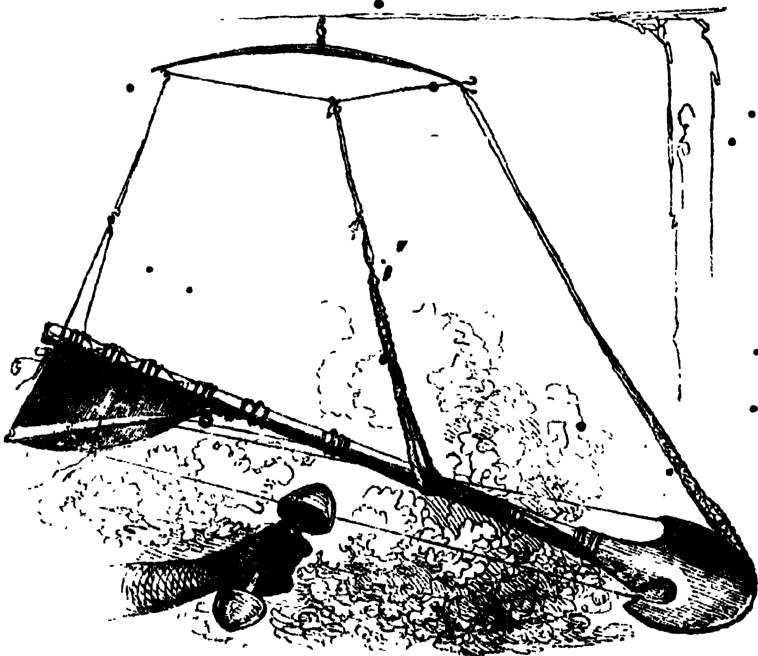


The mill consists of two rollers of teak wood, fluted longitudinally with five or six grooves, and revolving nearly in contact. The upper roller is turned by a handle, and the lower is carried along with it by a perpetual screw at the axis. The cotton is put in at one side, and drawn through by the revolving rollers; but

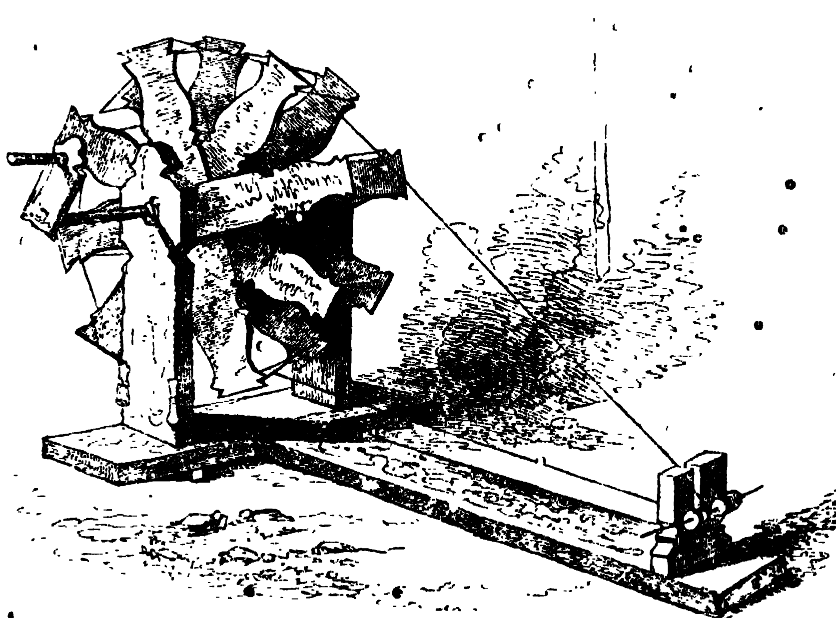
woman, and child is not employed in making a piece of cloth. At present, much the greatest part of the whole provinces are employed in this single manufacture." (p. 409.) "The progress of the *linen* (cotton) manufacture includes no less than a description of the lives of half the inhabitants of Indostan." (p. 413.) It is curious that Mr. Orme invariably mistakes *cotton* for *linen*; where he uses the latter word, the former is always to be understood.

the seeds, being too large to pass through the opening, are torn off, and fall down on the opposite side from the cotton.

The next operation is that of bowing the cotton, to clear it from dirt and knots. A large bow, made elastic by a complication of strings, is used; this being put in contact with a heap of cotton, the workman strikes the string with a heavy wooden mallet, and its vibrations open the knots of the cotton, shake from it the dust and dirt, and raise it to a downy fleece. The hand-mill and the bow have been used immemorially throughout all the countries of Asia, and have their appropriate names in the Arabic and other languages: they were formerly used in America, whence the term, still applied in commerce, "*bowed Georgia cotton.*" The hatters of our own country still raise their wool by the bow. The following is the Indian bow:—



The cotton being thus prepared, without any carding, it is spun by the women; the coarse yarn is spun on a heavy one-thread wheel, of teak-wood, and of the rudest carpentry—



The finer yarn is spun with a metallic spindle, sometimes with and sometimes without a distaff; a bit of clay is attached as a weight to one end of the spindle, which is turned round with the left hand, whilst the cotton is supplied with the right; the thread is wound up on a small piece of wood. The spinster keeps her fingers dry by the use of a chalky powder. In this simple way the Indian women, whose sense of touch is most acute and delicate, produce yarns which are finer and far more tenacious than any of the machine-spun yarns of Europe.

The yarn, having been reeled and warped in the sim-

plest possible manner, is given to the weaver, whose loom is as rude a piece of apparatus as can be imagined. It is thus described:—"The loom consists merely of two "bamboo rollers, one for the warp and the other for the "web, and a pair of geer. The shuttle performs the "double office of shuttle and batten, and for this purpose "is made like a large netting needle, and of a length "somewhat exceeding the breadth of the piece.* This "apparatus the weaver carries to a tree, under which he "digs a hole large enough to contain his legs and the "lower part of the geer. He then stretches his warp "by fastening his bamboo rollers at a due distance from "each other on the turf by wooden pins. The balances "of the geer he fastens to some convenient branch of the "tree over his head: two loops underneath the geer, in "which he inserts his great toes, serve instead of trea-"dles; and his long shuttle, which also performs the "office of batten, draws the weft through the warp, and "afterwards strikes it up close to the web."† "There "is not so much as an expedient for rolling up the warp: "it is stretched out at the full length of the web, which "makes the house of the weaver insufficient to contain "him. He is therefore obliged to work continually in "the open air; and every return of inclement weather "interrupts him."‡

The following is a representation of the Hindoo weaver and his loom:—

* The shuttle is not always of this length. Hoole, in his "Mission to India," represents it as requiring to be *thrown*, in which case it must be short; and a drawing of a Candyan weaver, in the Magazine of the Society for the Diffusion of Useful Knowledge, shews the shuttle of the same size as an English shuttle.

† Martin's Circle of the Mechanical Arts, p. 239.

‡ Mill's History of British India, book ii. ch. 8.



Forbes describes the weavers in Guzerat, near Baroche, as "fixing their looms at sun-rise under the "shade of tamarind and mango trees." In some parts of India, however, as on the banks of the Ganges, the weavers work under the cover of their sheds, fixing the geer of their looms to a bamboo in the roof. They size their warps with a starch made from the root called

kandri. When chequered muslins are wrought, three persons are employed at each loom: the *lungri* pulls the threads to form the pattern, the *dobarah* twists the thread, and the *binkarai* weaves.

Some authentic particulars concerning the habits and remuneration of the Hindoos engaged in the making of cotton cloth, are contained in an unpublished account of the districts of Puraniya (Purneah,) Patna, and Dinajpur, by Dr. Francis Hamilton, better known as Dr. F. Buchanan, (he having taken the name of Hamilton,) the author of the "Journey from Madras through Mysore, Canara, and Malabar." This account of the above-named provinces near the Ganges is in several manuscript volumes in the library of the India House, in London. I learn from his elaborate survey that the spinning and weaving of cotton prevails throughout these provinces. The fine yarns are spun with an iron spindle, and without distaff, generally by women of rank; no cast is disgraced here by spinning, as in the south of India;* the women do not employ all their time at this work, but only so much as is allowed by their domestic occupations. The coarse yarns are spun on "a small "miserable wheel turned by the hand." The hand-mill is used to free the cotton from its seeds, and the bow to tease it. "The following capital is required for the "weaver's business: a loom, 2½ rupees; sticks for warp-"ing and a wheel for winding, 2 anas; a shop, 4 rupees; "thread for two ready money pieces, worth 6 rupees

* In his work on Mysore, Dr. Buchanan says—"The women of the Brâhmans are averse from spinning as their husbands are from holding the plough." But Mr. Orme says—"A weaver among the Gentoos is no despicable cast; he is next to the scribe, and above all the mechanics; he would lose his cast were he to undertake a drudgery which did not immediately relate to his work."

"each, 3 rupees;—total 11 rupees 10 anas; to which "must be added a month's subsistence. The man and "his wife warp, wind, and weave two pieces of this kind "in a month, and he has 7 rupees (14 shillings) profit, "deducting, however, the tear and wear of his apparatus, "which is a trifle. A person hired to weave can in a "month make three pieces of this kind, and is allowed "2 anas in the rupee of their value, which is 2¼ rupees "(4s. 6d.) a month. The finest goods cost 2 rupees a "piece for weaving." In his observations on another district, Dr. Hamilton states the average profit of a loom engaged in weaving coarse goods to be 28 rupees (£2. 16s.) a year, or something less than 13d. a week. At Puraniya and Dinajpur the journeymen cotton-weavers "usually made from 2 to 2½ rupees (from 4s. to 5s.) a month." At Patna a man and his wife made from 3 to 4 rupees (from 6s. to 8s.) a month by beating and cleaning cotton; and each loom employed in making chequered muslins, and therefore employing *three* persons, has a profit of 108½ rupees a *year* (£10. 16s.), that is, 1s. 4d. a week for each person. The average earnings of a journeyman weaver, therefore, appear to be from 1s. to 1s. 4d. per week. At Bangalore, and in some other parts of southern India, this author states that weavers earn from 3d. to 8d. a day, according as they are employed on coarse or fine goods;* but this is so very much above the usual remuneration for labour in India, that, if the statement is not erroneous, it must be of extremely limited application. On the same authority, a woman spinning coarse yarn can earn in the same parts 1⅜d. per day.†

* Buchanan's Journey through Mysore, vol. i. pp. 216—218.

† Ibid. vol. iii. p. 317.

A fact is mentioned by Dr. Hamilton, in his unpublished account of Patna, which affords a striking indication as to the national character of the Hindoos—"All "Indian weavers, who weave for common sale, make the "woof of one end of the cloth *coarser* than that of the "other, and attempt to *sell* to the unwary *by the fine* "*end*, although every one almost, who deals with them, "is perfectly aware of the circumstance, and although "in the course of his life any weaver may not ever have "an opportunity of gaining by this means."

The East India Company has a factory at Dacca, and also in other parts of India,—not, as the modern English use of the word "factory" might seem to imply, a mill, for the manufacture is entirely domestic,—but a commercial establishment in a manufacturing district, where the spinners, weavers, and other workmen are chiefly employed in providing the goods which the Company exports to Europe. This establishment is under the management of a commercial resident, who agrees for the kinds of goods that may be required, and superintends the execution of the orders received from the presidencies. Such is the poverty of the workmen, and even of the manufacturers who employ them, that the resident has to advance beforehand the funds necessary in order to produce the goods. The consequence of this system is, that the manufacturers and their men are in a state of dependence almost amounting to servitude. The resident obtains their labour at his own price, and, being supported by the civil and military power, he establishes a monopoly of the worst kind, and productive of the most prejudicial effects to industry. The Act of 1833, which put an end to the commercial character of

the Company, will of course abolish all the absurd and oppressive monopolies it exercised.

It cannot but seem astonishing, that in a department of industry, where the raw material has been so grossly neglected, where the machinery is so rude, and where there is so little division of labour, the results should be fabrics of the most exquisite delicacy and beauty, unrivalled by the products of any other nation, even those best skilled in the mechanic arts. This anomaly is explained by the remarkably fine sense of touch possessed by that effeminate people, by their patience and gentleness, and by the hereditary continuance of a particular species of manufacture in families through many generations, which leads to the training of children from their very infancy in the processes of the art. Mr. Orme observes—" The women spin the thread destined for the " cloth, and then deliver it to the men, who have fingers " to model it as exquisitely as these have prepared " it. The rigid, clumsy fingers of a European would " scarcely be able to make a piece of canvas with the " instruments which are all that an Indian employs in " making a piece of cambric (muslin.) It is further " remarkable, that every distinct kind of cloth is the " production of a particular district, in which the fabric " has been transmitted perhaps for centuries from father " to son,—a custom which must have conduced to the " perfection of the manufacture."* The last mentioned fact may be considered as a kind of division of labour.

Mr. Mill thus explains the unequalled manual skill of the Indian weaver:—" It is a sedentary occupation, and " thus in harmony with his predominant inclination. It

* Orme's Historical Fragments of the Mogul Empire, p. 413.

"requires patience, of which he has an inexhaustible "fund. It requires little bodily exertion, of which he "is always exceedingly sparing; and the finer the pro- "duction, the more slender the force which he is called "upon to apply. But this is not all. The weak and "delicate frame of the Hindu is accompanied with an "acuteness of external sense, particularly of touch, which "is altogether unrivalled; and the flexibility of his fin- "gers is equally remarkable. The hand of the Hindu, "therefore, constitutes an organ adapted to the finest "operations of the loom, in a degree which is almost or "altogether peculiar to himself."*

It is, then, to a physical organization in the natives, admirably suited to the processes of spinning and weaving; to the possession of the raw material in the greatest abundance; to the possession also of the most brilliant dyes for staining and printing the cloth; to a climate which renders the colours lively and durable; and to the hereditary practice, by particular casts, classes, and families, both of the manual operations and chemical processes required in the manufacture;—it is to these causes, with very little aid from science, and in an almost barbarous state of the mechanical arts, that India owes her long supremacy in the manufacture of cotton.

Bengal is celebrated for the production of the finest muslins; the Coromandel coast, for the best chintzes and calicoes; and Surat, for strong and inferior goods of every kind. The cottons of Bengal go under the names of *casses*, *amâns*, and *yarats;* and the handkerchiefs are called Burgoses and Steinkirkes. Tablecloths of superior quality are made at Patna. The *basins*, or *basinets*, come from the Northern Circars. Condaver furnishes

* Mill's History of British India, book ii. c. 8.

the beautiful handkerchiefs of Masulipatam, the fine colours of which are partly obtained from a plant called *chaye*, which grows on the banks of the Krishna, and on the coast of the Bay of Bengal. The chintzes and ginghams are chiefly made at Masulipatam, Madras, St. Thomé, and Paliamcotta. The long cloths and fine pullicats are produced in the presidency of Madras. The coarse piece-goods, under the names of baftas, doutis, and pullicats, as well as common muslins and chintzes, are extensively manufactured in the district of which Surat is the port. Besides all these, there is an endless variety of fabrics, many of which are known in the markets of Europe, Asia, and Africa.

The commerce of the Indians in these fabrics has been extensive, from the Christian era to the end of the last century. For many hundred years, Persia, Arabia, Syria, Egypt, Abyssinia, and all the eastern parts of Africa, were supplied with a considerable portion of their cottons and muslins, and with all which they consumed of the finest qualities, from the marts of India. This commerce existed in the last age, and is described by the Abbé Raynal* and Legoux de Flaix. The blue calicoes of Guzerat were long bought by the English and Dutch for their trade with Guinea. The great marts of this commerce on the west coast of India were Surat and Calicut, the former of which is near to Baroche, the manufacturing capital of Guzerat, in which province a considerable part of the exported cottons of India were made; and on the east coast, Masulipatam, Madras, and St. Thomé, whence the varied and extensive products of the Coromandel coast are exported.

* Histoire Philosophique et Politique des Establissements et du Commerce des Européens dans les deux Indes, tom. ii. liv. iv. ch. 1.

Owing to the beauty and cheapness of Indian muslins, chintzes, and calicoes, there was a period when the manufacturers of all the countries of Europe were apprehensive of being ruined by their competition. In the seventeenth century, the Dutch and English East India Companies imported these goods in large quantities; they became highly fashionable for ladies' and children's dresses, as well as for drapery and furniture, and the coarse calicoes were used to line garments. To such an extent did this proceed, that as early as 1678 a loud outcry was made in England against the admission of Indian goods, which, it was maintained, were ruining our ancient woollen manufacture,—a branch of industry which for centuries was regarded with an almost superstitious veneration, as a kind of palladium of the national prosperity, and which was incomparably the most extensive branch of manufactures till the close of the eighteenth century. A few extracts from pamphlets published in the seventeenth and at the beginning of the eighteenth century, will not only afford amusement, but will shew the wonderful commercial revolution which has since been effected by the machinery of England. In the year 1678, a pamphlet was issued under the title—"The Ancient Trades Decayed and Repaired again," in which the author thus bewails the interference of cotton with woollen fabrics:—

"This trade (the woollen) is very much hindered by our own people, who do wear many foreign commodities instead of our own; as may be instanced in many particulars; viz. instead of green sey, that was wont to be used for children's frocks, is now used *painted and Indian-stained and striped calico;* and instead of a perpetuana or shalloon to lyne men's coats with, is used sometimes a *glazened calico,* which in the whole is not above 12d cheaper, and abundantly worse. And sometimes is used a *Ban-*

gale, that is brought from India, both for lynings to coats, and for petticoats too; yet our English ware is better and cheaper than this, only it is thinner for the summer. To remedy this, it would be necessary to lay a very high impost upon all such commodities as these are, and that no callicoes or other sort of linen be suffered to be glazened."—pp. 16, 17.

The writer, with equal wisdom, recommends the prohibition of stage coaches, on account of their injuring the proprietors of the inns on the road, by conveying the passengers too quickly, and at too little expense to themselves. A pamphlet entitled "The Naked Truth, in an Essay upon Trade," published in 1696, informs us that—

"The commodities that we chiefly receive from the East Indies are callicoes, muslins, Indian wrought silks, peper, salt-petre, indigo, &c. The advantage of the Company is chiefly in their muslins and Indian silks, (a great value in these commodities being comprehended in a small bulk,) and these *becoming the general wear in England*."—p. 4. "Fashion is truly termed a witch; the dearer and scarcer any commodity, the more the mode; 30s. a yard for muslins, and only the shadow of a commodity when procured."—p. 11.

So sagacious and far-sighted an author as Daniel De Foe did not escape the general notion, that it was not merely injurious to our woollen and silk manufactures, but also a national evil, to have clothing cheap from abroad rather than to manufacture it dear at home. In his *Weekly Review*, which contains so many opinions on trade, credit, and currency far beyond the age, he thus laments the large importations of Indian goods:—

"The general fansie of the people runs upon East India goods to that degree, that the *chints* and *printed calicoes*, which before were only made use of for carpets, quilts, &c., and to clothe children and ordinary people, become now the dress of our ladies;

and such is the power of a mode as we saw our persons of quality dressed in Indian carpets, which but a few years before their chambermaids would have thought too ordinary for them: the chints was advanced from lying upon their floors to their backs, from the foot-cloth to the petticoat; and even the queen herself at this time was pleased to appear in China and Japan, I mean China silks and callico. Nor was this all, but it crept into our houses, our closets, and bed-chambers; curtains, cushions, chairs, and at last beds themselves, were nothing but callicoes or Indian stuffs; and in short, almost every thing that used to be made of wool or silk, relating either to the dress of the women or the furniture of our houses, was supplied by the Indian trade."

"Above half of the (woollen) manufacture was entirely lost, half of the people scattered and ruined, and all this by the intercourse of the East India trade."—*Weekly Review, January* 31st, 1708.

However exaggerated and absurd De Foe's estimate of the injury caused to the woollen manufacture, as manifested by the small value of the whole importations of Indian fabrics, at that time, as well as (much more decisively) by the experience of recent times, when the woollen manufacture has sustained the incomparably more formidable competition of the English cotton manufacture, it is evident from his testimony, and that of other writers, that Indian calicoes, muslins, and chintzes, had become common in England at the close of the seventeenth century. De Foe's complaint was not of an evil existing in 1708, when he wrote, but of one a few years earlier; for he says in another place, that the prohibition of Indian goods had averted the ruin of our manufactures, and revived their prosperity. This prohibition took place by the Act 11 and 12 William III. cap. 10., (1700,) which forbad the introduction of Indian silks and printed calicoes for domestic use, either as apparel or furniture, under a penalty of £200 on the wearer

or seller: and as this Act did not prevent the continued use of the goods, which were probably smuggled from the continent of Europe, other Acts for the same purpose were passed at a later date.

A volume published in the year 1728, and entitled "A Plan of the English Commerce," shows that the evil of a consumption of Indian manufactures still prevailed, and that it was ascribed to a cause for which the writer saw no remedy, namely, the will of the ladies, or, in his own words, their "passion for their fashion." The other countries of Europe are represented as equally suffering from Indian competition and female perverseness, and as attempting in the same way to find a remedy in legislative prohibition. Holland was an honourable exception. The author says—

"The callicoes are sent from the Indies by land into Turkey, by land and inland seas into Muscovy and Tartary, and about by long-sea into Europe and America, till in general they are become a grievance, and almost all the European nations but the Dutch restrain and prohibit them."—p. 180.

"Two things," says the writer, "among us are too ungovernable, viz. our *passions* and our *fashions*.

"Should I ask the ladies whether they would dress by law, or clothe by act of parliament, they would ask me whether they were to be statute fools, and to be made pageants and pictures of?—whether the sex was to be set up for our jest, and the parliament had nothing to do but make Indian queens of them?—that they claim English liberty as well as the men, and as they expect to do what they please, and say what they please, so they will wear what they please, and dress how they please.

"It is true that the liberty of the ladies, their *passion* for their *fashion*, has been frequently injurious to the manufactures of England, and is so still in some cases; but I do not see so easy a remedy for that, as for some other things of the like nature. The ladies have suffered some little restraint that way, as in the wearing

East India silks, instead of English; and callicoes and other things instead of worsted stuffs and the like; and we do not see they are pleased with it."—p. 253.

It appears, then, that not more than a century ago, the cotton fabrics of India were so beautiful and cheap, that nearly all the governments of Europe thought it necessary to prohibit them, or to load them with heavy duties, in order to protect their own manufactures. How surprising a revolution has since taken place! The Indians have not lost their former skill; but a power has arisen in England, which has robbed them of their ancient ascendancy, turned back the tide of commerce, and made it run more rapidly against the Oriental than it ever ran against the English. Not to dwell upon a point which will afterwards be illustrated, the following document furnishes superabundant proof how a manufacture which has existed without a rival for thousands of years, is withering under the competition of a power which is but of yesterday: it would be well if it did not also illustrate the very different measure of protection and justice which governments usually afford to their subjects at home, and to those of their remote dependencies:—

"PETITION OF NATIVES OF BENGAL, RELATIVE TO DUTIES ON COTTON AND SILK.

"*Calcutta*, 1*st. Sept.* 1831.

"TO THE RIGHT HONOURABLE THE LORDS OF HIS MAJESTY'S PRIVY COUNCIL FOR TRADE, &c.

"The humble Petition of the undersigned Manufacturers and Dealers in Cotton and Silk Piece Goods, the fabrics of Bengal;

"SHEWETH—That of late years your Petitioners have found their business nearly superseded by the introduction of the fabrics

of Great Britain into Bengal, the importation of which augments every year, to the great prejudice of the native manufactures.

"That the fabrics of Great Britain are consumed in Bengal, without any duties being levied thereon to protect the native fabrics.

"That the fabrics of Bengal are charged with the following duties when they are used in Great Britain—

"On manufactured cottons, 10 per cent.
"On manufactured silks, 24 per cent.

"Your Petitioners most humbly implore your Lordships' consideration of these circumstances, and they feel confident that no disposition exists in England to shut the door against the industry of any part of the inhabitants of this great empire.

"They therefore pray to be admitted to the privilege of British subjects, and humbly entreat your Lordships to allow the cotton and silk fabrics of Bengal to be used in Great Britain 'free of duty,' or at the same rate which may be charged on British fabrics consumed in Bengal.*

"Your Lordships must be aware of the immense advantages the British manufacturers derive from their skill in constructing and using machinery, which enables them to undersell the unscientific manufacturers of Bengal in their own country: and, although your Petitioners are not sanguine in expecting to derive any great advantage from having their prayer granted, their minds would feel gratified by such a manifestation of your Lordships' good will towards them; and such an instance of justice to the natives of India would not fail to endear the British government to them.

"They therefore confidently trust, that your Lordships' righteous consideration will be extended to them as British subjects, without exception of sect, country, or colour.

"And your Petitioners, as in duty bound, will ever pray."

[Signed by 117 natives of high respectability.]

* This reasonable request has not been complied with, the duty on India cotton being still 10 per cent. The extra duty of 3½d. per yard on printed cottons was taken off when the excise duty on English prints was repealed, in 1831. English cottons imported into India only pay a duty of 2½ per cent.

It is the object of the present work to show the means and the steps by which this surprising commercial revolution has been effected; and to that I now proceed,—concluding the notice of the Indian manufacture with a passage from the writings of an enlightened foreigner, who has shown the extent of the triumph gained over that manufacture, by English skill, in the following just and eloquent terms:—

"Watt improves the steam-engine, and this single improvement "causes the industry of England to make an immense stride. "This machine represents, at the present time, the power of three "hundred thousand horses, or of two millions of men, strong and "well fitted for labour, who should work day and night without "interruption, and without repose, to augment the riches of a "country not two-thirds the extent of France. A hair-dresser "invents, or at least brings into action, a machine for spinning "cotton; this alone gives to British industry an immense superi-"ority. Fifty years only after this great discovery, more than one "million of the inhabitants of England are employed in those ope-"rations, which depend, directly or indirectly, on the action of "this machine. Lastly, England exports cotton, spun and woven "by an admirable system of machinery, to the value of four hun-"dred millions of francs yearly. The Indies, so long superior to "Europe—the Indies, which inundated the west with her products, "and exhausted the riches of Europe—the Indies are conquered in "their turn. The British navigator travels in quest of the cotton "of India,—brings it from a distance of four thousand leagues,—"commits it to an operation of the machine of Arkwright, and of "those that are attached to it,—carries back their products to "the East, making them again to travel four thousand leagues;—"and, in spite of the loss of time, in spite of the enormous ex-"pense incurred by this voyage of eight thousand leagues, the "cotton manufactured by the machinery of England becomes less "costly than the cotton of India spun and woven by the hand near "the field that produced it, and sold at the nearest market. So "great is the power of the progress of machinery."*

* Address of M. Charles Dupin to the Mechanics of Paris.

CHAPTER VII.

THE COTTON MANUFACTURE IN ENGLAND.

England among the latest of all countries to receive the Cotton Manufacture.—The natural advantages of England, and especially of Lancashire, for manufactures, unequalled by any other country; water-power, coal, iron; communication with the sea; inland navigation; railways: commercial position of the country.—Political and moral advantages of England.—Adventitious advantages.—The woollen and linen manufactures prepared the way for the cotton manufacture in Lancashire.—Notice of the woollen manufacture.—The ancient "Manchester cottons" a woollen fabric.—"Cottons" and "fustians" made of wool, in imitation of the foreign goods bearing those names.—Early importation of cotton-wool into England; then used chiefly for candlewicks; imported from Genoa, Sicily, the Levant, and Flanders.—Mercantile commission to Turkey.—The cotton manufacture probably introduced at the close of the sixteenth century, by Protestant refugees from Flanders.—First mention of the English cotton manufacture, by Lewes Roberts, in 1641.—Humphrey Chetham a dealer in fustians before this time.—Fustians manufactured chiefly at Bolton and the neighbourhood, and bought by the Manchester merchants.—Species of cotton goods made at Manchester.—Modes of doing business.—Calico printing commenced in England.—Rapid increase of the town and trade of Manchester at the beginning of the eighteenth century.—Testimony of Stukely and De Foe.—Extensive consumption of linen yarn as warps for cotton goods.—Extent of the manufacture in 1740 and 1760.—Official returns of the imports of cotton wool, and exports of British cotton goods, from 1697 to 1764.—Contrast between that period and 1833.—Comparison of the cotton and woollen exports in 1700 and 1833.

England was among the latest of all countries to receive the cotton manufacture. This species of industry was known in each of the other quarters of the globe earlier than in Europe; and in Spain, Italy, the Low Countries, Bavaria, Saxony, Prussia, and Turkey, before it was introduced into England. That a country which started almost last in the race should have so far

outstripped every competitor may appear surprising, but admits of satisfactory explanation; and it will be desirable here to glance at the principal causes which have given the English a pre-eminence in manufactures over all other nations.

The natural and physical advantages of England for manufacturing industry are probably superior to those of every other country on the globe. The district where those advantages are found in the most favourable combination, is the southern part of Lancashire, and the south-western part of Yorkshire, the former of which has become the principal seat of the manufacture of cotton. In the counties of Cheshire, Derbyshire, and Nottinghamshire, and in Renfrewshire and Lanarkshire, in Scotland, all of which districts are likewise seats of this branch of industry, advantages of a similar nature are found, though not in such close concentration as in Lancashire.

Three things may be regarded as of primary importance for the successful prosecution of manufactures, namely, water-power, fuel, and iron. Wherever these exist in combination, and where they are abundant and cheap, machinery may be manufactured and put in motion at small cost; and most of the processes of making and finishing cloth, whether chemical or mechanical, depending, as they do, mainly on the two great agents of water and heat, may likewise be performed with advantage.

The tract lying between the Ribble and the Mersey is surrounded on the east and north by high ranges of hills, and has also hills of some magnitude in the hundreds of Blackburn and Salford; owing to which cause the district is intersected by a great number of streams,

which descend rapidly from their sources towards the level tract in the west. In the early part of their course, these streams and streamlets furnish water-power adequate to turn many hundred mills:* they afford the element of water, indispensable for scouring, bleaching, printing, dyeing, and other processes of manufacture: and when collected in their larger channels, or employed to feed canals, they supply a superior inland navigation, so important for the transit of raw materials and merchandise.

Not less important for manufactures than the copious supply of good water, is the great abundance of coal found in the very same district. Beds of this invaluable mineral lie beneath almost the whole surface of Blackburn and Salford hundreds, and run into West Derby to within a few miles of Liverpool; and being near the surface, so as to yield their treasures easily, they are incomparably more fertile sources of wealth than mines of silver and gold. It is superfluous to remark that this mineral fuel animates the thousand arms of the steam-engine, and furnishes the most powerful agent in all chemical and mechanical operations.

Of the equally indispensable metal, iron, the southern part of Lancashire is nearly destitute; but being at no

* On the river Irwell, from the first mill near Bacup, to Prestolee, near Bolton, there is about 900 feet of fall available for mills, 800 of which is occupied. On this river and its branches it is computed that there are no less than three hundred mills. A project is in course of execution to increase the water-power of the district, already so great and so much concentrated, and to equalize the force of the stream, by forming eighteen reservoirs on the hills, to be filled in times of flood, and to yield their supplies in the drought of summer. These reservoirs, according to the plan, would cover 270 acres of ground, and contain 241,300,000 cubic feet of water, which would give a power equal to 6,600 horses. The cost is estimated at £59,000. One reservoir has been completed, another is in course of formation, and it is probable that the whole design will be carried into effect.

great distance from the iron districts of Staffordshire, Warwickshire, Yorkshire, Furness, and Wales, with all of which it has ready communication by inland or coasting navigation, it is as abundantly and almost as cheaply supplied with this material, as if the iron was got within its own boundaries.

In mentioning the advantages which Lancashire possesses as a seat of manufactures, we must not omit its ready communication with the sea by means of its well-situated port, Liverpool, through the medium of which it receives, from Ireland, a large proportion of the food that supports its population, and whose commerce brings from distant shores the raw materials of its manufactures, and again distributes them, converted into useful and elegant clothing, amongst all the nations of the earth. Through the same means a plentiful supply of timber is obtained, so needful for building purposes.

To the above natural advantages, we must add, the acquired advantage of a canal communication, which ramifies itself through all the populous parts of this county, and connects it with the inland counties, the seats of other flourishing manufactures, and the sources whence iron, lime, salt, stone, and other articles in which Lancashire is deficient, are obtained. By this means Lancashire, being already possessed of the primary requisites for manufactures, is enabled, at a very small expense, to command things of secondary importance, and to appropriate to its use the natural advantages of the whole kingdom. The canals, having been accomplished by individual enterprise, not by national funds, were constructed to supply a want already existing: they were not, therefore, original sources of the manufactures, but have extended together with

them, and are to be considered as having essentially aided and accelerated that prosperity from whose beginnings they themselves arose. The recent introduction of railways will have a great effect in making the operations of trade more intensely active, and perfecting the division of labour, already carried to so high a point. By the railway and the locomotive engine, the extremities of the land will, for every beneficial purpose, be united.

In comparing the advantages of England for manufactures with those of other countries, we can by no means overlook the excellent commercial position of the country—intermediate between the north and south of Europe; and its insular situation, which, combined with the command of the seas, secures our territory from invasion or annoyance. The German ocean, the Baltic, and the Mediterranean are the regular highways for our ships; and our western ports command an unobstructed passage to the Atlantic, and to every quarter of the world.

A temperate climate, and a hardy race of men, have also greatly contributed to promote the manufacturing industry of England.

The political and moral advantages of this country, as a seat of manufactures, are not less remarkable than its physical advantages. The arts are the daughters of peace and liberty. In no country have these blessings been enjoyed in so high a degree, or for so long a continuance, as in England. Under the reign of just laws, personal liberty and property have been secure; mercantile enterprise has been allowed to reap its reward; capital has accumulated in safety; the workman has "gone forth to his work and to his labour until

the evening;" and, thus protected and favoured, the manufacturing prosperity of the country has struck its roots deep, and spread forth its branches to the ends of the earth.

England has also gained by the calamities of other countries, and the intolerance of other governments. At different periods, the Flemish and French protestants, expelled from their native lands, have taken refuge in England, and have repaid the protection given them by practising and teaching branches of industry, in which the English were then less expert than their neighbours. The wars which have at different times desolated the rest of Europe, and especially those which followed the French revolution, (when mechanical invention was producing the most wonderful effects in England,) checked the progress of manufacturing improvement on the continent, and left England for many years without a competitor. At the same time, the English navy held the sovereignty of the ocean, and under its protection the commerce of this country extended beyond all former bounds, and established a firm connexion between the manufacturers of Lancashire and their customers in the most distant lands.

When the natural, political, and adventitious causes, thus enumerated, are viewed together, it cannot be matter of surprise that England has obtained a pre-eminence over the rest of the world in manufactures.

The woollen and linen manufactures have existed in this country from a very early period, and both of them were carried on in Lancashire before the cotton manufacture, for which they prepared the way. England has been immemorially famous for its wool, of which it produced abundance before any woollens, except of the

coarsest kind, were made here: the wool was then chiefly exported to Flanders, where that manufacture was in an extremely flourishing state. Manchester was a seat of the woollen manufacture as early as the reign of Edward II. In a survey of that town in the time of John Delawar, the eighth baron, about the year 1313, I find the following entry—"A *mill* for the *dyers* on the banks of the Irk, [valued] at xiijs. iiijd. per annum."* And in an extent of the manor of Manchester, in the year 1322, mention is made of a *fulling mill* turned by the same river.†

The woollen manufacture, however, was rude and insignificant in England until the reign of Edward III., who, having married Philippa of Hainault, found means to bring over a considerable number of woollen manufacturers from Flanders,‡ granting them letters of protection, and tempting them with well-founded hopes of large profits and good living. The Flemings were settled in York, Kendal, Halifax, Manchester, the dis-

* MS. History of Manchester, in the possession of James Thomson, esq. of Clitheroe.

† Kuerden's MS. fo. 274.

‡ "Hitherto," says Fuller, "the English were ignorant of that art, as knowing no more what to do with their wool than the sheep that weare it, as to any artificial curious drapery; their best clothes then being no better than friezes, such was their coarseness for want of skill in making. But soon after followed a great alteration." Edward III. having married the daughter of the earl of Hainault, sent emissaries among the Dutch, to tempt over their workmen, whose slavish and degraded condition made them anxious to find a better country. "Early up and late in bed," says our author, "and all day hard work and harder fare—a few herrings and mouldie cheese, and all to enrich the churls their masters, without any profit to themselves. But, oh! how happy," said the emissaries of Edward, "should they be, if they would but come over to England, bringing their mystery, which would provide them welcome in all places! Here they should feed on fat beef and mutton till nothing but their fullness should stint their stomach; yea, they should feed on the labours of their own hands, enjoying a proportionable profit of their pains to themselves: their beds should be good, and their bed-fellows better; seeing the richest yeomen in England would not disdain to marry

tricts of Rossendale and Pendle, Norwich, Essex, Kent, and the west of England. Nothing is distinctly known of the progress of the woollen manufacture in Lancashire until the reign of Henry VIII., at which time it had evidently grown into considerable importance. Hollinworth mentions, that about the year 1520, "there were three famous clothiers living in the north countre, viz. Cuthbert of Kendal, Hodgkins of Halifax, and Martin Brian (some say, Byrom) of Manchester. Every one of these kept a great number of servants at work, carders, spinners, weavers, fullers, dyers, sheermen," &c.* Leland, the antiquary, who visited Manchester about the year 1538, speaks of the town in the following terms:—"Mancestre, on the south side of the Irwell river, stondeth in Salfordshiret, and is the fairest, best builded, quickhest, and most populus tounne of al Lancastreshire." Nor was it then the only seat of manufactures in this county. The same writer says—"Bolton-upon-Moore market stondith most by *cottons*; divers villages in the moores about Bolton do make *cottons*." It will afterwards be seen, that the goods here called "cottons" were really woollens.

The most important testimony to the extent and

their daughters unto them. Persuaded by their promises, many Dutch servants leave their masters, and make over for England. With themselves they brought over their trade and their tools. The king, having gotten this treasure of foreigners, thought not fit to continue them all in one place, but bestowed them through all parts of the land, that cloathing might thereby be the better dispersed. Those yeomen in whose houses they harboured, soon preceded gentlemen, gained great estates to themselves, and arms and worship to their estates. Here they found fuller's earth, a precious treasure, whereof England hath better than all Christendom besides. And now was the English wool improved to the highest profit, passing through so many hands, every one having a fleece of the fleece,—sorters, combers, carders, spinners, weavers, fullers, dyers, pressers, packers; and these manufactures have been heightened to the highest degree of perfection.'—Fuller's Church History, p. 110.

* Hollinworth's Mancuniensis.

nature of the manufactures of Manchester at this period, is contained in the statute of 33 Henry VIII. c. xv. for removing the privilege of sanctuary; from which it appears that the inhabitants carried on a considerable manufacture both of linens and woollens, by which they were acquiring wealth; that many strangers from other parts of England, and from Ireland, resorted thither with linen yarn and wool, to have them made into cloth; and that a system of credit was established: on all which accounts it was found desirable to transfer the mischievous privilege of "sanctuary," which was a powerful attraction for thieves, from Manchester to a place where there was less property to be stolen.

This act mentions so many particulars concerning the trade of Manchester at that time, that the introductory part ought not to be omitted:—

Whereas, the saide towne of Manchester is and hath of long tyme been a towne well inhabited, and the kinges subiectes inhabitauntes of the same towne are well set a worke in makinge of clothes, as well of lynnen as of woollen, whereby the inhabitauntes of the saide towne haue obteyned gotten and come vnto riches and welthy lyuings, and haue kepte and set manye artificers and poore folkes to worke within the said towne, and by reason of the great occupienge good order strayte and true dealing of the inhabitantes of the said towne, many strangers, as wel of Ireland as of other places within this realme, haue resorted to the saide towne with lynnen yarne, woolles, and other necessary wares for makinge of clothes, to be solde there, and haue vsed to credit & truste the poore inhabitantes of the same towne, which were not able and had not redy money to paye in hande for the saide yarnes wolles and wares vnto such time the saide credites with their industry labour and peynes myght make clothes of the said wolles yarns and other necessary wares, and solde the same, to contente and paye their creditours, wherein hath consisted much of the common welth of the said towne, and many poore folkes had lyuynge, and children and seruants there vertuously brought up in honest

true labour, out of all ydlenes And for as muche as of necessitie the said Lynnen yarne must lye without as well in the night as in the day cõtinually for the space of one halfe yere to be whited, before it can be made clothe, and the wollen clothes there made must hange vppon the taynter, to be dryed before it can be dressed up, and for the saulfegarde therof it is and shalbe expediẽt and necessary, that substanciall honest iuste true and credible persons be and shuld dwell in the sayd towne, and no maner of lyght personne or persons there to be inhabytauntes. And where also many straungers inhabytinge in other towneshyps and places, haue vsed customably to resorte to the sayd towne of Manchester with a great number of cottons, to be vttered & solde to the inhabitantes of the same towne, to the great profit of all the inhabitantes of the same and therby many poore people haue ben well set a worke, as wel with dressyng & frisyng of the sayd cottons, as with puttyng to sale the same,"—&c.

From the mention of "cottons" in this statute, and in Leland's account of Bolton, it has been supposed that the cotton manufacture has existed at least three centuries in England. But this is certainly a mistake, as, however curious the fact may be, there is undoubted evidence that the "cottons" of Manchester, like the Kendal and Welsh "cottons" of the present day, were a coarse kind of woollens. A decisive proof of this is afforded by the statute above quoted, in which it is said that the cottons were "dressed and *frised*,"—frising being a process only applicable to woollens, as it consists in the raising and curling of the woolly nap. Another proof of the same fact is found in an act of the 5th and 6th Edward VI. (1552) entitled, "for the true making of *woollen* cloth," in which it is ordered, that "all the *cottons* called *Manchester*, Lancashire, and Cheshire *cottons*, full wrought to the sale, shall be in length twenty-two yards, and contain in breadth three-quarters of a yard in the water, and shall weigh thirty pounds in

the piece at least." Another still more conclusive proof is contained in the act of the 8th Elizabeth, c. xi. (1566), for regulating the aulnegers' (measurers') fees, and the length, breadth, and weight of cottons, frizes, and rugs, made in the county of Lancaster; in which it is enacted that "every of the said *cottons*, being sufficiently *milled* or thicked, clean scoured, well wrought and fully dried, shall weigh 21lbs. at the least." The process of *milling*, like that of frising, is only applicable to *woollen* fabrics. The application of the term "cottons" to a woollen manufacture is also expressly mentioned by Camden, who, speaking of Manchester in 1590, says—"'This town excels the towns immediately around it in handsomeness, populousness, *woollen manufacture*, market-place, church and college; but did much more excel them in the last age, as well by the glory of its *woollen* cloths, (*laneorum pannorum honore*,) which they call *Manchester cottons*, as by the privilege of sanctuary, which the authority of parliament, under Henry VIII., transferred to Chester."

It is not a little singular, that a manufacture destined afterwards to eclipse not merely "the glory" of the old "Manchester cottons," but that of all other manufactures, should thus have existed in name long before it existed at all in fact. It has been conjectured, that the word "cottons" was a corruption of "coatings;" but it is very evident that the name was adopted from the foreign cottons, which, being fustians and other heavy goods, were imitated in woollen by our manufacturers.

The word "fustians" was in the same manner applied to a certain kind of woollen or worsted goods made at Norwich and in Scotland. Blomefield, the

historian of Norfolk, speaking of the rapid advances of Norwich in the woollen manufacture, in the reign of Edward III. (about the year 1336,) says, "Soon after this, Norwich, in a very few years, became the most flourishing city in all England, by means of its great trade in worsteds, *fustians*, freezes, and *other woollen* manufactures; for now the English wool, being manufactured by English hands, an incredible profit accrued to the people by its passing through and employing so many."*

In an act passed in 1504, c. 17, for regulating the company of shearmen, of Norwich, it is stated, that "in Norwich, time out of mind, there had been used a certain craft called shearmen, for shearing as well worsteds, stamins, and *fustians*, as also all *other woollen cloth*."

A sumptuary law of James I. passed in the parliament of Scotland, in 1621, (act 25 of 23 Parl. Jac. VI.) enacts, "that servants shall have no silk on their cloaths, except buttons and garters, and shall wear only cloth, *fustians*, canvas, and stuffs of Scotch manufacture." There can be no doubt that the fustians here mentioned, if a Scotch fabric, were made of sheep's wool.

A similar adaptation of the name of one manufacture to another of a different material, made in imitation of it, is found in our own day, when a description of cotton goods, made in Scotland, has been named *cambric*,—being an imitation of the linen fabric of that name.

The exact period when the cotton manufacture was introduced into England is unknown. The article of cotton-wool had for centuries been imported in small

* Essay towards a Topographical History of the County of Norfolk; by the Rev. Francis Blomefield; vol. ii. p. 62.

quantities, to be used as candle-wicks, as appears from an entry in the books of Bolton abbey, in Yorkshire, in the year 1298—"In. sapo et *coton* ad candelam, xvii s. id."* The next mention of cotton-wool that I have met with, is in "The Processe of the Libel of English Policie," the old poem quoted at p. 43, originally published in 1430, and republished in Hakluyt's Collection of early Voyages: the trade of the Genoese with England is thus described:—

> "The Genuois comen in sundry wies
> Into this land by diuers marchandises
> In great Caracks, arrayed withouten lacke
> With cloth of gold, silke, and pepper blacke
> They bring with them, and of croodt† great plentee,
> Woll Oyle, Woad ashen, by vessel in the see,
> *Cotton*, Rochalum, and good gold of Genne;
> And then be charged with wolle again I wenne,
> And wollen cloth of ours of colours all."

At the beginning of the sixteenth century, the evidences of a regular importation of cotton become more numerous. Hakluyt records that "in the yeeres of our Lord 1511, 1512, &c. till the year 1531, diuers tall ships of London, [he mentions five,] with certaine other ships of Southampton and Bristow, had an ordinary and vsual trade to Sicilia, Candie, Chio, and somewhiles to Cyprus, as also to Tripolis and Barutti, in Syria. The commodities which they carried thither were, fine kersies of diuers colours, course kersies, white Westerne dozens, cottons, [no doubt, strong woollens,] certain clothes called statutes, and others called cardinal-whites,

* Dr. Whitaker's History of Craven, p. 384 (2d edition, 1812.) This antiquarian, whose prejudices against manufactures were violent and ridiculous, says, in a note on the above extract—"This substance, (cotton,) of which the manufactory is become so extensive and so pernicious, was then imported in small quantities from the Levant."

† Woad.

and caluesking, which were well sold in Sicilie, &c. The commodities which they brought backe were silks, chamlets, rubarbe, malmesies, muskudels and other wines, sweete oyles, *cotten wool*, Turkie carpets, galles, pepper, cinnamon, and some other spices."*

In the year 1569, "A Discourse of the Trade to Chio" was published by Gaspar Campion, in which he says —"There is cotton wooll, &c. and also course wooll to make beds." "We had three kintals of cotten wooll for a carsie, and solde the wooll in England for 50 shillings or 3 pound at the most; whereas, now the Italians sell the same to vs for 4 pound ten shillings and 5 pound the hundred:" "And so all other commodities that the Venetians do bring, they sell them to vs for the third part more gaines then we ourselues in those dayes that we traded in those parts."† Cotton was also an article of importation from Antwerp in the year 1560.‡

It is evident that cotton wool had long been in use, but, in all probability, it was only for candle-wicks, and other minor purposes, not at all for the manufacture of cloth. No mention has yet been found of the cotton manufacture earlier than the year 1641; and there are good reasons for concluding that it could not have existed very long before that period. In the act of the 43d of Elizabeth, (1601,) the celebrated Poor Law, overseers of the poor are empowered to buy "a convenient stock of flax, hemp, wool, thread, iron, and other necessary ware or stuff, to set the poor on work;" but in this enumeration of raw materials, comprising those of all the principal manufactures then known, cotton is not mentioned. Camden, who wrote in 1590,

* Hakluyt, vol. ii. p. 206. † Ibid. vol. ii. p. 228-9.
‡ Macpherson's Annals of Commerce, vol. ii. p. 131.

and the authors of several other works, on the trade, manufactures, and topography of the country, published during the following half century, are silent as to any manufacture of cotton.

In the year 1582, a commercial treaty having been formed with Turkey, and a Levant company established, a mercantile commission was sent from London to Constantinople and other parts of Turkey, to learn any secrets in manufacturing and dyeing that might be useful to the domestic industry and foreign trade of England, and thus tend to give employment to "our poor people withall, and promote the general enriching of this realme." Instructions of a very full and precise nature were drawn up for this commission by Mr. Richard Hakluyt, brother of the compiler of the Voyages; and the individuals sent, were "to note all kinds of clothing in Turkie, and all degrees of their labour in the same." It was prescribed to them, "If you shall find that they make any cloth of any kind that is not made in this realme, that is there of great use, then to bring of the same into this realme some mowsters, that our people may fall into the trade, and prepare the same for Turkey." Yet the writer of the instructions makes not the least allusion to cotton clothing, and evidently has no view but to the improvement of the woollen manufacture, and the adaptation of the different kinds of woollen goods to the taste of the Turks. If the cotton manufacture had then been practised in England, even on a small scale, it is highly probable that this commission would have received directions either to observe the processes of the manufacture in the East, or to inquire concerning the supply of the raw material.

It is not impossible that this very commission, acting

on the general principle of its instructions,* might bring to England the art of making cotton cloth. But I am more inclined to think that the art was imported from Flanders, about the same time, by the crowd of Protestant artisans and workmen who fled from Antwerp, on the capture and ruin of that great trading city by the duke of Parma in 1585; and also from other cities of the Spanish Netherlands. Great numbers of these victims of a sanguinary persecution took refuge in England, and some of them settled in Manchester; and there is the stronger reason to suppose that the manufacture of cotton would then be commenced here, as there were restrictions and burdens on foreigners setting up business as masters in England, in the trades then carried on in this country, whilst foreigners commencing a *new* art would be exempt from those restrictions.* The warden and fellows of Manchester college had the wisdom to encourage the settlement of the foreign clothiers in that town, by allowing them to cut firing from their extensive woods, as well as to take the timber necessary for the construction of their looms, on paying the small sum of four-pence yearly.

At that period of our history, when capital was small, and the movements of trade comparatively sluggish, a new manufacture would be likely to extend itself slowly, and to be long before it attracted the notice of authors. That a manufacture might in those days gradually take root and acquire strength, without even for half a century being commemorated in any book that should be extant after the lapse of two centuries more, will be easily credited by those who have searched for the records of our modern improvements in the same manu-

* Macpherson's Annals of Commerce, vol. ii. p. 176

facture! If the greatest mechanical inventions and the most stupendous commercial phenomena have passed almost unnoticed in a day when authors were so numerous, the mere infancy of the cotton manufacture may well have been without record in an age when the press was far less active.

We may decisively infer from the first mention that has been discovered of the cotton manufacture in England, that it had been growing up for a considerable time before that account was written. This passage, memorable in the history of the manufacture, is found in a little work by Lewes Roberts, called "The Treasure of Traffic," published in 1641. It is as follows:—

"The town of Manchester, in Lancashire, (says he,) must be also herein remembered, and worthily for their encouragement commended, who buy the yarne of the Irish in great quantity, and, weaving it, returne the same again into Ireland to sell: Neither doth their industry rest here, for they buy *cotton wool* in London, that comes first from Cyprus and Smyrna, and at home worke the same, and perfect it into *fustians, vermillions, dimities*, and other such stuffes, and then return it to London, where the same is vented and sold, and not seldom sent into forrain parts, who have means, at far easier termes, to provide themselves of the said first materials." (Orig. Edition, pp. 32, 33.)

The same author further says—

"The Levant or Turkey Company brings in return thereof (i. e. of English woollens) great quantity of *Cotten* and *Cotten-yarne*, Grogram yarne, and raw silke into England, (which shewes the benefit accruing to this kingdom by that Company); for here the said cloth is first shipped out and exported in its full perfection

dyed and drest, and thereby the prime native commoditie of this kingdom is increased, improved, and vented, and the cotten yarne and raw silk obtained." (p. 34.)

From the above evidence it is manifest that the cotton manufacture had in 1641 become well established at Manchester. It not only then supplied the home trade with several kinds of cotton goods, but furnished them as a regular article of exportation from the metropolis to the distant markets of the Levant; and the importation of cotton-wool and cotton-yarn had also become regular and considerable. Manchester still retained its manufacture of linen; and as linen-yarn was used as the warp for fustians and nearly all other cotton goods in this country down to the year 1773, it may be said that the linen manufacture prepared the way for the cotton manufacture, and long continued its auxiliary. It may, therefore, from all the above facts, be regarded as in a very high degree probable, that the cotton manufacture was introduced into England towards the close of the sixteenth century, by the Flemish protestant emigrants.

This view receives confirmation from a passage in Fuller's "Worthies of England." Dr. Fuller, who wrote in 1662, in his notice of Humphrey Chetham, the celebrated founder of the Blue Coat hospital and library at Manchester, who was born in the year 1580, says—

"George, Humphrey, and Ralph (Chetham,) embarked in the trade for which Manchester had for some time been distinguished, the chief branch of which was the manufacture of cottons. Bolton at that period was no less the market for *fustians*, which were brought thither from all parts of the surrounding country. Of these last especially the Chethams were the principal buyers, and

the London market was chiefly supplied by them with those materials of apparel, *then in almost general use throughout the nation.*" Humphrey Chetham, "when high-sheriffe of this county, 1635, discharged the place with great honour; inasmuch that very good gentlemen, of birth and estate, did wear his cloth at the assize, to testifie their unfeigned affection to him; and two of them (John Huntley, and H. Wrigley, esqs.) of the same profession with himself, have since been sheriffs of the county." (Vol. i. p. 554.)

This passage shows that fustians were "in almost general use throughout the nation" whilst the Chethams were in business; and as Humphrey Chetham was high-sheriff in 1635, when he was fifty-five years of age, we may conclude that he had then dealt in that article for a number of years. Of course, fustians must have been made at Manchester and Bolton for a considerable time before the publication of Lewes Roberts's book.

The spread of the manufacture was afterwards by no means rapid. The same obstacles which impeded its growth in the other countries of Europe, impeded it in England. Owing to the rudeness of the spinning machinery, fine yarn could not be spun, and of course fine goods could not be woven. Fustians, dimities, and other strong fabrics were made; but calicoes and the more delicate cotton goods were not attempted.

From "A Description of the towns of Manchester and Salford," attached to a plan of the towns, taken about the year 1650, the following information is derived relative to trade:—"The trade is not inferior to that of many cities in the kingdom, chiefly consisting in *woollen frizes*, *fustians*, *sack-cloths*, *mingled stuffs*, *caps*, *inkles*, *tapes*, *points*, &c., whereby not only the better sort of

men are employed, but also the very children, by their own labour, can maintain themselves. There are, besides, all kinds of foreign merchandise brought and returned by the merchants of the town, amounting to the sum of many thousands of pounds weekly."*

Dr. Fuller, whose authority has been already quoted, and whose work was published in 1662, gives some further information concerning the manufactures of Manchester and Bolton. The passage will not be the less acceptable, if we preserve the quaint conceits of the old divine. After mentioning the names of the Jen, Augsburgh, and Milán fustians, he says:—

"These retain their old names at this day, though these several sorts are made in this country, whose inhabitants, buying the *Cotton Wool* or *Yarne,* coming from beyond the sea, make it here into fustians, to the good imployment of the poor, and great improvement of the rich therein, serving mean people for their outsides, and their betters for the lineing of their garments. *Bolton* is the *staple-place* for this commodity, being brought thither from *all parts of the country.*

"As for *Manchester*, the *Cottons*† thereof carry away the credit in our nation, and so they did an hundred and fifty years agoe. For when learned Leland, on the cost of king Henry the Eighth, with his guide, travailed Lancashire, he called Manchester the fairest and quickest town in this county; and sure I am, it hath lost neither spruceness nor spirits since that time.

"Other commodities made in Manchester are so

* Aikin's "History of Manchester," in which the "Description" is said to "abound in terms of exaggeration." p. 154.

† There can be no doubt that these "*cottons*" were the *woollen* fabric of that name, as they are said to have been famous one hundred and fifty years before.

small in themselves, and various in their kinds, they will *fill the shop of an Haberdasher of small wares.* Being, therefore, too many for me to reckon up or remember, it will be the safest way to wrap them all together in some *Manchester-Tickin,* and to fasten them with the *Pinns,* (to prevent their falling out and scattering,) or tye them with the *Tape,* and also (because sure bind, sure find) to bind them about with *Points* and *Laces,* all made in the same place."*

From this passage we should infer, that fustians were manufactured in many parts of Lancashire, and taken for sale to Bolton market; and that, although these and other cotton goods were made at Manchester, yet the species of manufacture for which that town was still most remarkable, were its strong *woollens* and *small wares.* As the mercantile metropolis of the county, Manchester bought fustians and other goods, as they came from the loom, in the neighbouring towns and villages, finished them for sale, and then sold them at its variously-stored marts.† "The kinds of fustian then made were herring-bones, pillows for pockets and outside wear, strong cotton ribs and barragon, broad-raced lin thicksets and tufts, dyed, with white diapers, striped dimities, and lining jeans. Cotton thicksets were made

* Fuller's Worthies of England, Vol. I. p. 537. edit. 1811.

† Dr. Aikin explains this more fully:—"Fustians were manufactured about Bolton, Leigh, and the places adjacent; but Bolton was the principal market for them, where they were bought in the grey by the Manchester chapmen, who finished and sold them in the country. The Manchester traders went regularly on market-days to buy pieces of fustian of the weaver; each weaver then procuring yarn or cotton as he could, which subjected the trade to great inconvenience. To remedy this, some of the chapmen furnished warps and wool to the weavers, and employed persons on commission to put out warps to the weavers. They also encouraged weavers to fetch them from Manchester, and, by prompt payment and good usage, endeavoured to secure good workmanship."—*History of Manchester,* p. 158.

sometimes, but as frequently dropped for want of proper finishing. When tufts ceased to be in demand, more figured goods were made for whiting, and a greater variety of patterns attempted, by weavers who had looms ready mounted for the former purposes. But as figures made with treadles are confined to a scanty range, beyond which they grow too complicated, the workmen had recourse to the use of draw-boys, which gave name to a new and important branch of trade."*

At this period, the extent of mercantile establishments, and the modes of doing business, were extremely different from what they are at present. Though a few individuals are found who made fortunes by trade, it is probable that the capital of merchants was generally very small, until the end of the seventeenth century, and all their concerns were managed with extreme frugality. Masters commonly participated in the labours of their servants. Commercial enterprise was exceedingly limited. Owing to the bad state of the roads, and the entire absence of inland navigation, goods could only be conveyed on pack-horses, with a gang of which the Manchester chapmen used occasionally to make circuits to the principal towns, and sell their goods to the shopkeepers,—bringing back with them sheep's wool, which was disposed of to the makers of worsted yarn at Manchester, or to the clothiers of Rochdale, Saddleworth, and the West Riding of Yorkshire. It was only towards the close of the seventeenth century, that trade became sufficiently productive to encourage the general erection of brick houses in Manchester, in place of the old dwellings, constructed of wood and plaster. So great was the increase of the manufactures and trade of England

* Aikin's History of Manchester, p. 158.

towards the close of this century, that the exports rose from £2,022,812, in 1662, (and they were about the same in 1668,) to £6,788,166, in 1699.*

In the latter part of the seventeenth century and the beginning of the eighteenth, such considerable importations of Indian calicoes, muslins, and chintzes were made, as to excite the vehement opposition of our manufacturers, and to lead parliament to exclude those goods by heavy penalties. This has already been shewn in the chapter on the Indian cotton manufacture, page 77 to 81. The jealousy felt in England was not, however, on behalf of our cotton manufacture, but of our woollen and silk manufactures; which sufficiently proves that no cotton goods were then made in England of the fine and light qualities of those from India.

The business of calico printing was commenced in London in the latter part of the seventeenth century; and for the sake of encouraging this branch of industry, plain Indian calicoes were admitted under a duty. In 1712, the business had become sufficiently extensive to lead parliament to impose an excise duty of 3d. per square yard on calicoes printed, stained, painted, or dyed, (10 Anne, c. 19.); and in 1714, the duty was raised to 6d. per square yard, (12 Anne, sec. 2, c. 9.) But the history of the printing, and of the legislative interferences with the cotton trade, will be given in a subsequent part of this work.

In the twenty years from 1720 to 1740, which was a period of almost uninterrupted peace, Manchester, as well as many other commercial towns, continued to make

* Dr. Davenant's Report to the Commissioners of Accounts; and Anderson's Origin and History of Commerce, Vol. II. pp. 227, 228.

rapid strides in wealth, population, and manufacturing eminence.

Dr. Stukely, who visited Manchester about 1720, says, in his *Itinerarium Curiosum*,—"The trade, which is incredibly large, consists much in fustians, girthwebb, tukings, tapes, &c., which are dispersed all over the kingdom, and to foreign parts."

Daniel de Foe, in his "*Tour through the whole Island of Great Britain*," published in 1727, speaking of Manchester, says, "That within a very few years past, here, as at Liverpoole, and also at Froome in Somersetshire, the town is extended in a surprising manner, being almost double to what it was a few years ago. So that, taking in all its suburbs, it now contains at least 50,000 people. [This must have included the whole parish.] The grand manufacture which has so much raised this town is that of *cotton* in all its varieties, which, like all our other manufactures, is very much increased within these thirty or forty years."*

De Foe says also, "About eight miles from Manchester, N.W., lies Bolton. We saw nothing remarkable in it, but that the cotton manufacture reached hither, though the place did not, like Manchester, seem increasing. We turned east here, and came to Bury, a small market town on the river Roch, which is the utmost bound of the cotton manufacture, which flourishes so well at Manchester."†

* De Foe's Tour, Vol. III. p. 219.

† On the antiquity of the cotton manufacture, De Foe was extremely ill-informed. He says, "The antiquity of the manufacture is indeed worth taking notice of; which, though we cannot trace it by history, we have reason to believe began something earlier than the woollen manufactures in other parts of England, of which I have spoken so often; because the cotton might itself come from the Mediterranean, and be known by correspondents in those counties, when that of

As linen yarn was used for the warps of cotton goods, the progress of the cotton manufacture increased the demand for linen yarn to such an extent as to inconvenience the linen weavers of Scotland and Ireland, who complained of the yarn being bought out of their hands, at a high price, to be sent to Manchester, and there wrought up with cottons. Such complaints are noticed in the reports of the Linen Board of Dublin, in the years 1734, 1736, and 1738; in the first of which, the value of the yarn imported into England is estimated at 40 or £50,000 a year. The quantity of linen yarn imported from Ireland into Great Britain increased from 13,734 cwts. in 1731, to 18,519 cwts. in 1740, and 22,231 cwts. (2,489,872 lbs.) in 1750. The linen yarn of Germany, called Hamburgh yarn, was also imported to make warps for the English cottons.

An article in the *Daily Advertiser*, of September 5, 1739, and which was also copied into the *Gentleman's Magazine*, says—"The manufacture of *cotton*, mixed and plain, is arrived at so great perfection within these twenty years, that we not only make enough for our own consumption, but supply our colonies, and many of the nations of Europe. The benefits arising from this branch are such as to enable the manufacturers of Manchester alone to lay out above thirty thousand pounds a year, for many years past, on additional buildings. 'Tis computed, that two thousand new houses have been

wool was not pushed there, because our neighbours wrought the goods; and though they brought the wool from England, yet we did not want the goods; whereas without making the cotton goods at home, our people could not have them at all." vol. iii. p. 221. This speculation, which receives not the least support from history, may, perhaps, have been suggested to De Foe by the old name of the Manchester woollens, ("cottons,") by which other writers have been led into a similar mistake

built in that industrious town within these twenty years."

In a rapidly advancing country, the great things of one age are insignificant in the eyes of the succeeding age. Thus, the period of 1739, whose prosperity was so much vaunted, is now looked back upon as the mere feeble infancy of the cotton manufacture—a trickling rill, compared with the mighty river to which that manufacture has since swelled. At that time the consumption of cotton wool did not exceed 1-200th part of the consumption at the present day. The following returns, from the records of the Custom-house, for which I am indebted to the kindness of the Right Hon. Poulett Thomson, the President of the Board of Trade, and which have never before been published, will show how scanty were the imports of cotton wool and the exports of British cotton manufactures, in the first half of the last century:—

QUANTITY OF COTTON WOOL IMPORTED.

Year 1697	1,976,359 lbs.
1701	1,985,868
1710	715,008
1720	1,972,805
1730	1,545,472
1741	1,645,031
1751	2,976,610
1764	3,870,392

(Signed) W. IRVING.

Export of British Cotton Goods.

Years.	Official Value of British Cotton Goods of all sorts exported.
1697	£5,915
1701	23,253
1710	5,698
1720	16,200
1730	13,524
1741	20,709
1751	45,986
1764	200,354

(Signed) W. Irving.

It has been repeatedly stated, in works of great respectability, as on the authority of Dr. Percival, of Manchester, that, "at the accession of George III., in 1760, the entire value of all the cotton goods manufactured in great Britain was estimated to amount to only £200,000 a year." This great error could not have been committed, if the returns of the exports had been published: it now appears, from the second of the above tables, that the value of the cotton goods *exported* in 1764 was £200,354; of course, the whole value of the cottons *manufactured* must have greatly exceeded this, as the domestic consumption is likely to have been much greater than the export.

In all probability, Postlethwayt, the author of the "Universal Dictionary of Trade and Commerce," approached to correctness, when, in the year 1766, he estimated the annual value of the cottons made at £600,000. He says—"The manufactures called Man-

chester wares, such as fustians, cottons, tapes, incle, &c. are sent on pack-horses to London, Bristol, Liverpool, &c. for exportation, and also to the wholesale haberdashers for home consumption; whence the other towns of England are likewise served, or by the Manchester men themselves, who travel from town to town throughout the kingdom. Of these goods they make, at Manchester, Bolton, and the neighbouring places, above £600,000 annually."

The following return of the quantities of cotton wool imported and exported, is taken from a report of a committee of the house of commons on the linen manufacture, published in Postlethwayt's Dictionary, under the head "Linen:"—

Cotton Wool Imported and Exported.

Years.	Imported. lbs.	Exported. lbs.	Retained for home consumption. lbs.
1743	1,132,288	40,870	1,091,418
1744	1,882,873	182,765	1,700,108
1745	1,469,523	73,172	1,369,351
1746	2,264,808	73,279	2,191,529
1747	2,224,869	29,438	2,195,431
1748	4,852,966	291,717	4,561,249
1749	1,658,365	330,998	1,327,367

Compare the above official returns of imports and exports, for the first half of the 18th century, with the present imports of cotton wool and exports of cotton manufactures:

Cotton Wool Imported in 1833.

303,726,199 lbs.

British Cotton Manufactures Exported in 1833.

Real or Declared Value.

£18,486,400.

In the year 1701, when the exportation of cotton goods did not exceed £23,253, (which appears to have been above the average for the next forty years,) the exportation of woollen goods (according to Dr. Davenant and Mr. Gregory King) amounted to £2,000,000, forming above a fourth of the whole export trade of the kingdom. So great has been the change in the relative proportions of these manufactures, that, whilst the woollen exports have increased only to £6,539,731 in 1833, the cotton exports amounted in the same year to £18,483,400. The woollen manufacture has continued to extend, but its rate of increase bears no proportion to that of the cotton manufacture, which mocks all that the most romantic imagination could have previously conceived possible under any circumstances.

CHAPTER VIII.

THE ERA OF INVENTION.

Remarks on inventors and inventions.—Obstacles to the extension of the manufacture, from the rudeness of the machinery.—Invention of the fly shuttle by John Kay, in 1738; and of the drop box by Robert Kay.—The one-thread spinning wheel.—Invention of SPINNING BY ROLLERS, by John Wyatt, of Birmingham.—Description of the process of spinning.—Patent for spinning by rollers taken out, in 1738, in the name of Lewis Paul.—Proofs that Wyatt was the author of this great invention.—Cotton spinning mills at Birmingham and Northampton.—Extracts from Wyatt's MS. book on cotton spinning, and prices of yarn—Letter of Mr. Chas. Wyatt on his father's invention.—Paul's second patent for a spinning machine in 1758.—Probability that Sir Richard Arkwright knew of Wyatt's invention.—Claims of Thomas Highs to the invention of spinning by rollers.

We have now arrived at the era of invention; and a series of inventions is to be opened, which for ingenuity and importance has never been equalled in any other manufacture.

I cannot better introduce a history, which, however splendid in its national results, is sometimes obscure as to the claims of individuals, and more often melancholy as to their fate, than by quoting the following excellent remarks on inventors and inventions from an old writer:—*

"Few new inventions were ever rewarded by a monopoly; for altho' the Inventor, oftentimes drunk with the opinion of his own merit, thinks all the world will

* A Treatise on Taxes and Contributions, published in 1679, and which I have only seen in the British Museum.

invade and encroach upon him, yet I have observed that the generality of men will scarce be hired to make use of the new practices, which themselves have not throughly tried, and which length of time hath not vindicated from latent inconvenience; so as when a new invention is first propounded, in the beginning every man objects, and the poor inventor runs the Gantloop of all petulent wits; every man finding his several flaw, no man approving it unless mended according to his own device. Now not one of a hundred outlives this torture, and those that do are at length so changed by the various contrivances of others, that not any one man can pretend to the invention of the whole, nor well agree about their respective shares in the parts. And moreover this commonly is so long a-doing, that the poor inventor is either dead, or disabled by the debts contracted to pursue his design; and withal railed upon as a projector, or worse, by those who joyned their money in partnership with his wit; so as the said inventor and his pretences are wholly lost and vanisht." —p. 53.

Every stage in the improvement of the cotton manufacture illustrates the truth of these remarks. It is melancholy to contrast with the sanguine eagerness of inventors, the slowness of mankind to acknowledge and reward their merits,—to observe how, on many occasions, genius, instead of realizing fame and fortune, has been pursued by disaster and opposition,—how trifling difficulties have frustrated the success of splendid discoveries,—and how those discoveries, snatched from the grasp of their broken-hearted authors, have brought princely fortunes to men whose only talent was in making money. When inventors fail in their projects,

no one pities them; when they succeed, persecution, envy, and jealousy are their reward. Their means are generally exhausted before their discoveries become productive. They plant a vineyard, and either starve, or are driven from their inheritance, before they can gather the fruit.

Up to the year 1760, the machines used in the cotton manufacture in England were nearly as simple as those of India; though the loom was more strongly and perfectly constructed, and cards for combing the cotton had been adopted from the woollen manufacture.

The cotton manufacture, though rapidly increasing, could never have received such an extension as to become of great national importance, without the discovery of some method for producing a greater quantity and better quality of yarn with the same labour. None but the strong cottons, such as fustians and dimities, were as yet made in England, and for these the demand must always have been limited. Yet at present the demand exceeded the supply, and the modes of manufacture were such as greatly to impede the increase of production. The weaver was continually pressing upon the spinner. The processes of spinning and weaving were generally performed in the same cottage, but the weaver's own family could not supply him with a sufficient quantity of weft, and he had with much pains to collect it from neighbouring spinsters. Thus his time was wasted, and he was often subjected to high demands for an article, on which, as the demand exceeded the supply, the seller could put her own price.* A high

* Dr. Aikin says, "The weavers, in a scarcity of spinning, have sometimes been paid less for the weft than they paid the spinner, but durst not complain, much less abate the spinner, lest their looms should be unemployed."—*Hist. of*

and sustained price of yarn would indeed have attracted new hands to the employment, but such high price would itself have tended to keep down the rising manufacture, by making the goods too costly in comparison with other manufactures.

This difficulty was likely to be further aggravated by an invention which facilitated the process of weaving. In the year 1738, Mr. John Kay, a native of Bury, in Lancashire, then residing at Colchester, where the woollen manufacture was at that time carried on, suggested a mode of throwing the shuttle, which enabled the weaver to make nearly twice as much cloth as he could make before. The old mode was, to throw the shuttle with the hand, which required a constant extension of the hands to each side of the warp.* By the new plan, the lathe (in which the shuttle runs) was lengthened a foot at either end; and, by means of two strings attached to the opposite ends of the lathe, and both held by a peg in the weaver's hand, he, with a slight and sudden pluck, was able to give the proper impulse to the shuttle. The shuttle thus impelled was called the *fly-shuttle*, and the peg was called the *picking-peg*, (*i. e.* the *throwing* peg.) This simple contrivance was a great saving of time and exertion to the weaver, and enabled

Manchester, p. 167. Mr. Guest, in his "History of the Cotton Manufacture," states, that "it was no uncommon thing for a weaver to walk three or four miles in a morning, and call on five or six spinners, before he could collect weft to serve him for the remainder of the day; and when he wished to weave a piece in a shorter time than usual, a new ribbon, or a gown, was necessary, to quicken the exertions of the spinner." p. 12.

* In the first print of Hogarth's admirable series, "*Industry and Idleness*," where the two apprentices are seen at their looms, the old form of shuttle and lathe is represented: the industrious apprentice has the shuttle in his hand, ready to throw it; and the shuttle of the idle apprentice hangs dangling by the thread at the end of the lathe, affording a plaything for the cat, whilst the lad sleeps.

one man to weave the widest cloth, which had before required two persons. "Mr. Kay brought this ingenious invention to his native town, and introduced it among the woollen weavers, in the same year, but it was not much used among the cotton weavers until 1760. In that year Mr. Robert Kay, of Bury, son of Mr. John Kay, invented the *drop-box*, by means of which the weaver can at pleasure use any one of three shuttles, each containing a different coloured weft, without the trouble of taking them from and replacing them in the lathe."*

These inventions, like every other invention which has contributed to the extraordinary advance of the cotton manufacture, were opposed by the workmen, who feared that they would lose their employment; and such was the persecution and danger to which John Kay was exposed, that he left his native country, and went to reside in Paris.

It has been seen, that the great impediment to the further progress of the manufacture was the impossibility of obtaining an adequate supply of yarn. The one-thread wheel, though turning from morning till night in thousands of cottages, could not keep pace either with the weaver's shuttle, or with the demand of the merchant.

The one-thread wheel, though much improved from the rude teak-wood wheel used in India, (see p. 68,) was an extremely slow mode of spinning; as may be supposed from the subjoined representation of a spinster at her work:—

* Guest, p. 8. Mr. Guest derived his information on these points "from a manuscript lent to him by Mr. Samuel Kay, of Bury, son of Mr. Robert Kay, the inventor of the drop-box." p. 30.



The yarn was spun by two processes, called *roving* and *spinning*. In the first, the spinner took the short fleecy rolls in which the cotton was stripped off the hand-cards, applied them successively to the spindle, and, whilst with one hand she turned the wheel, and thus made the spindle revolve, with the other she drew out the cardings, which, receiving a slight twist from the spindle, were made into thick threads called rovings, and wound upon the spindle so as to form cops. In the second process, the roving was spun into yarn: the operation was similar, but the thread was drawn out finer, and received much more twist. It will be seen that this instrument only admitted of one thread being spun at a time by one pair of hands: and the slowness of the operation, and consequent expensiveness of the yarn, formed a great obstacle to the establishment of a new manufacture.

Genius stepped in to remove the difficulty, and gave wings to a manufacture which had been creeping on the

earth. A mechanical contrivance was invented, by which twenty, fifty, a hundred, or even a thousand threads could be spun at once by a single pair of hands!

The authorship of this splendid invention, like that of the art of printing, has been the subject of much doubt and controversy; and by far the greater number of writers have subscribed the honour to an individual, who, though possessed of extraordinary talent and merit, was certainly not the original inventor. Sir Richard Arkwright is generally believed, even to the present day, to have invented the mode of *spinning by rollers*. I shall prove, by a piece of evidence the most unquestionable, and which has never yet been published, that the invention was made, and was the subject of a patent, *thirty years* before it is pretended that Arkwright had conceived it. The inventor, it is true, did not succeed in making his own fortune, or even introducing his machine into general use; he wanted the *primum mobile*, pecuniary means, and could not hold out long enough to realize the success his genius had merited. The invention slumbered for nearly thirty years, till it was either re-discovered, or, what is more probable, till its principles came accidentally to the knowledge of Arkwright, whose keen sagacity appreciated its value, and whose perseverance, talent, and good fortune, enabled him, by its means, to enrich himself and his country.

The inventor of the mode of *spinning by rollers* was JOHN WYATT, of Birmingham. Before proceeding to adduce the proof of this statement, I shall describe this mode of spinning, as practised at the present day in the cotton, the woollen, the worsted, and the flax manufactures—for to all these branches has this invaluable machine been applied; and the reader will then be enabled to perceive the identity of principle in the

invention of Wyatt, and the machine brought into use by Arkwright, and now universally adopted.

In every mode of spinning, the ends to be accomplished are, to *draw out* the loose fibres of the cotton-wool in a regular and continuous line, and, after reducing the fleecy roll to the requisite tenuity, to *twist* it into a thread. Previous to the operation of spinning, the cotton must have undergone the process of carding, the effect of which is to comb out, straighten, and lay parallel to each other its entangled fibres. The cotton was formerly stripped off the cards in loose rolls, called cardings or slivers; and the only difference between the slivers produced by the old hand-cards and those produced by the present carding engine is, that the former were in lengths of a few inches, and the latter are of the length of some hundreds of yards. Let it be remarked, that the sliver or carding requires to be *drawn out* to a considerably greater fineness, before it is of the proper thickness to be twisted into a thread. The way in which this is now accomplished is by two or more pairs of small rollers, placed horizontally,—the upper and lower roller of each pair revolving in contact: the sliver of cotton, being put between the first pair of rollers, is by their revolution drawn through and compressed: whilst still passing through these rollers, it is caught by another pair of rollers placed immediately in front, which revolve with three, four, or five times the velocity of the first pair, and which therefore *draw out* the sliver to three, four, or five times its former length and degree of fineness: after passing through the second pair of rollers,* the reduced sliver is attached to a

* Three or more pairs of rollers are now used, to draw out and reduce the sliver more equally than could be done by two pairs; but the principle is exactly the same.

spindle and fly, the rapid revolutions of which *twist* it into a thread, and at the same time wind it upon a bobbin. That the rollers may take hold of the cotton, the lower roller is fluted longitudinally, and the upper is covered with leather. . .

Such is the beautiful and admirable contrivance, by which a machine is made to do what was formerly, in all countries and ages, effected by the fingers of the spinner. It is obvious that by lengthening or multiplying the rollers, and increasing the number of spindles, all of which may be turned by the same power, many threads may be spun at once, and the process may be carried on with much greater quickness and steadiness than hand-spinning. There is also the important advantage, that the thread produced will be of more regular thickness and more evenly twisted.

This is the invention ascribed to sir Richard Arkwright, and on which his renown for mechanical genius mainly rests. It will be found, however, that the process had previously been described, with the utmost distinctness, in the specification of the machine invented by John Wyatt, and that cotton had for some years been spun by those machines. The patent for the invention was taken out, in the year 1738, in the name of Lewis Paul, a foreigner, with whom Mr. Wyatt had connected himself in partnership, and the name of John Wyatt only appears as a witness; but there is other evidence to show that the latter was really the inventor. The reason why Paul was allowed to take out the patent can only be conjectured; it may have been, that Wyatt was then in embarrassed circumstances.

I proceed to give an attested copy of the patent and specification alluded to:—

PATENT FOR SPINNING BY ROLLERS, IN 1738.

" *Twentieth Part of Close Rolls, in the Twelfth Year of King George the Second.*

Paul, Lewis, Description of Patent. (20)

" To ALL TO WHOM THESE PRESENTS shall come, Lewis Paul, of Birmingham, in the County of Warwick, gentleman, Sendeth Greeting: Whereas his present Majesty by his royall Letters Patents under the Great Seal of Great Britain, bearing date the Twenty-fourth day of June, in the Twelfth year of his reign, Hath given and granted unto me, the said Lewis Paul, my executors, administrators, and assigns, sole privilege and authority to make, use, exercise, and vend *a new invented Machine* or Engine, *for the Spinning of Wool and Cotton,* in a manner entirely new, To have, hold, exercise, and enjoy the said lycence, unto me, my executors, administrators, and assigns, for the term of Fourteen Years from the date of the said Letters Patents, according to the statute in such case made and provided. In which said Letters Patents is contained a provisoe that if I, the said Lewis Paul, shall not particularly describe and ascertain the nature and form of my said Invention, and in what manner the same is to be performed, by an Instrument in writing under my hand and seal, and cause the same to be Inrolled in the High Court of Chancery, within two Calendar Months after the date of the said Patent, the same was to be void, as by the said Letters Patents, relation being thereunto had, may appear. Now know all men by these presents, that I, the said Lewis Paul, do by this present writeing under my hand and seal declare the nature and form of the said Invention to be, and the manner the same is to be performed by, is as follows, to wit, The said Machine, Engine, or Invention will spin Wooll or Cotton into Thread, yarn, or worsted, which, before it is placed therein, must be first prepared in manner following, (to wit) all those sorts of Wooll or Cotton which it is necessary to Card must have each Card-full, Batt, or Roll joyned together so as to make the mass become a kind of a Rope or Thread of Raw Wooll: In that sort of Wooll which it is necessary to combe, commonly called jarsey, a strict regard must be had to make the Slivers of an equal thick-

ness from End to End: The Wooll or Cotton being thus prepared, *one end. of the Mass*, Rope, Thread, or Sliver, *is put betwixt a pair of Rowlers*, Cillinders, or Cones, or some such movements, *which, being twined round by their motion, draws in the Raw Mass of Wooll or Cotton to be spun*, in proportion to the velocity given to such Rowlers, Cillinders, or Cones: as the prepared mass passes regularly through or betwixt these Rowlers, Cillinders, or Cones, *a succession of* OTHER ROWLERS, Cillinders, or Cones MOVEING PROPORTIONABLY FASTER THAN THE FIRST, *draw the Rope*, Thread, or Sliver, *into any degree of fineness which may be required*: sometimes these successive Rowlers, Cillinders, or Cones (but not the first) have another Rotation besides that which *diminishes the Thread*, yarn, or worsted, (viz.) that they give it a small degree of Twist, betwixt each pair, by means of the Thread itself passing through the axis and center of that Rotation. In some other cases only the first pair of Rowlers, Cillinders, or Cones are used, and then *the Bobbyn, spole, or quill upon which the Thread*, Yarn, or Worsted *is spun*, is so contrived as to *draw faster than the first Rowlers, Cillinders, or Cones give*, and *in such proportion as the first Mass, Rope, or Sliver is proposed to be diminished*. In witness whereof I have hereunto set my hand, and seal this Twentieth day of July in the year of our Lord *One thousand seven hundred and thirty eight*.

"LEWIS PAUL.

"Signed and sealed, (being first duly stamped) in the presence of us,

"SAML. GUY, JNO. WYATT."

"'AND BE IT REMEMBERED, That the Twentieth day of July, in the year above written, the aforesaid Lewis Paul came before our said Lord the King in his Chancery, and acknowledged the description aforesaid, and all and every thing therein contained and specified, in forme above written; and also the description aforesaid was stampt according to the tenor of the Statute made in the Sixth year of the Reign of the late King and Queen, William and Mary of England, and so forth. Inrolled the Twentieth day of July, in the year above written.

"THOMAS BENNETT.

"This is a true copy from the original record remaining in the Chapel of the Rolls, having been examined.

"JOHN KIPLING."*

This document proves, beyond all possible doubt, that the mode of spinning by rollers was invented more than thirty years before Arkwright took out his patent for a similar machine, which was not till 1769. I proceed to show that the inventor was John Wyatt, and not Lewis Paul, in whose name the patent was taken out. The first evidence is that of a letter from Mr. Wyatt himself, written when a prisoner for debt, after the failure of his concern—for he shared the common fate of inventors—and addressed to sir Leicester Holt, requesting him to support a bill, then before parliament, for the relief of insolvents. The original lies before me, and I make the following extract *verbatim et literatim*:—

"SIR,—Though I have not the honour to be personally known to Sir Leicester Holt, yet as my characture and misfortunes are pretty well known to some of the gentlemen in and about Birmingham, to whom Sir Leicester has vouchsafed his audience, I immagine it possible my name may have fill'd up some intervals of more agreeable conversation. But whether the mention of my name

* I am indebted for the copy of this important and hitherto unpublished document, to the kindness of Richard Guest, esq., author of the "History of the Cotton Manufacture," who, though he has, both in his "History," and his "Reply to an Article in the Edinburgh Review," advocated the claims of Thomas Highs to the invention of spinning by rollers, yet communicated to me, with the utmost candour and readiness, the proof that that invention has a considerably earlier date. Mr. Guest was not acquainted with this piece of evidence when he published either of his books, although he had made diligent search for it; the reason of his search being baffled was, that the patent has always been referred to as Wyatt's invention, which so far misled him in the search for it, that it was not procured until after the sheets of his last work were printed off. The attention of Mr. Guest was probably drawn to Wyatt's invention by a paper of John Kennedy, esq., published in the Memoirs of the Manchester Literary and Philosophical Society, which will be mentioned more particularly.

and behaviour can have done any credit to my person, Sir Leicester will judge if he has heard my case. I am the person that was *the principal agent in compileing the Spinning Engine*, though I had not the honour to wait upon Sir Leicester either of the times he was to see it." &c.

I have also before me two hanks of cotton-yarn spun about 1741, and wrapped in a piece of paper, on which is written the following, in the hand-writing of Mr. Wyatt:—

"The inclosed yarn, spun by the Spinning Engine (without hands) about the year 1741. The movement was at that time turn'd by two [or more] Asses, walking round an axis in a large warehouse, near the well in the Upper Priory, in Birmingham.

"It ow'd the condition it was then in to the superintendency of John Wyatt.

"The above wrote June 3d, 1756."*

A manuscript book is remaining, composed, (as appears from internal evidence, as well as from the letter of Mr. Wyatt's son, which will shortly be quoted,) by Mr. John Wyatt, entitled, "A Systematical Essay on

* John Kennedy, esq., of Manchester, well known for his scientific attainments, and many years an extensive cotton-spinner, (to whose obliging courtesy I am indebted for the loan of Mr. Wyatt's original papers, he having received them from Mr. Wyatt's son,) has pronounced the following opinion on these specimens of yarn, in a note to his paper "On the Rise and Progress of the Cotton Trade," published in the Memoirs of the Manchester Literary and Philosophical Society in 1819, (vol. iii. of the second series, p. 137.)—"From examining the yarn, I think it would not be said by competent judges that it was spun by a similar machine to that of Mr. Arkwright; for the fabric or thread is very different from the early productions of Mr. Arkwright, and is, I think, evidently spun by a different machine, the ingenuity of which we cannot appreciate, as the model mentioned in the paper alluded to is unfortunately lost." When this was written, Mr. Kennedy had not seen the specification of Wyatt's invention, as given in Paul's patent; but when he afterwards obtained it from the Patent-Office, no doubt was left on his mind that the invention was identical in principle, though not in all its details, with the machine of Arkwright.

the Business of Spinning; or the Manufacturing of Cotton Wool into Yarn, for various uses; without the intermediate application or intervention of the human fingers: wrote in the year 1743, for the private purposes of its Author." This book contains many curious and interesting particulars concerning the manufactory at Birmingham in 1741-2, and also concerning another manufactory, turned by water-power, at Northampton, in which Mr. Cave, the editor of the *Gentleman's Magazine,* was the monied partner, and a Mr. Yeomen was the manager. The manuscript explains in part the failure of the undertaking, as it appears that Mr. Wyatt *left* the concern at Birmingham, and resided a great deal in London, endeavouring to dispose of the yarn: disorder, negligence, and mismanagement, were the natural results of the absence of the principal. Wyatt also seems to have been ignorant of the prices of yarns, and, though possessing great abilities, he may not have had the business talent requisite to make such an undertaking succeed.

It appears from this MS. book, that Wyatt resided principally in London; in the years 1739 and 1740, during which time he was constantly inquiring about yarns; that he was at Birmingham in the beginning of 1741, observing the working of the manufactory, and that at that time Paul was one of its superintendents;* that Wyatt left Birmingham again for London, in March, 1741, but continued to take the interest of a principal in the concern; that at Michaelmas, 1743,

* Some person in whose hands the MS. book has been, has taken the pains to cross out with ink the name of "Mr. Paul," in the only two places where it is mentioned; but by a close inspection the name may be deciphered.

both the concerns at Birmingham and Northampton were at work, and Wyatt was endeavouring to dispose of their yarn, and to obtain cotton-wool to spin.

From the mention made of the machinery, it appears that the work at Northampton was moved by a water-wheel; that the engines consisted of several frames, bearing 250 spindles and bobbins; that the bobbin revolved upon the spindle, and that each was moved by a separate wheel and pinion, containing, the one sixty-four teeth, and the other sixty-five.* In one part of the book, the cost of "the bobbins, with the frame and appurtenances," is estimated at 20s. per bobbin, and "the wooden wheels, cards, &c." (including all the other tools and machines for carding, spinning, and reeling,) at 10s. per bobbin: and in another part of the book it is estimated, that "300 spindles (with the license) could be purchased for £1,200." Wyatt makes his calculations on the supposition of giving the yarn "twenty twists in an inch;" and he states, that "if the work was designed to spin the sort of forty twists per inch, it would take four times as much money to set up all such spindles, as those of twenty twists per inch."

The following page of Mr. Wyatt's Essay gives so much insight into the spinning establishment at Northampton, that I present a literal copy :—

* It is probable that Wyatt adopted the idea of arranging a number of spindles, with bobbins revolving upon them, in a frame, and of turning the spindles and bobbins by distinct wheels, from the machines for throwing silk, introduced by Sir Thomas Lombe, from Italy, and set up in a large mill at Derby. The introduction of the Italian silk-throwing machinery may have set Wyatt on considering whether other materials, as cotton and wool, might not be spun by a similar apparatus. The rollers, however, find no place in the silk machines.

"REMARKS ON MR. CAVE'S WORK AT NORTHAMPTON, Oct. 8th, 1743.

"1. They have spun in all about 50,000 skeins, since they first began.

"2. They spin 90 skeins per day at each *Frame*, for a day's work; at least, they call that their day's work.

"3. They have worn out but two *Pinions* since they began, and not one *wheel*.

"4. They have 5 frames up, but seldom hands to keep 4 at work.

"5. They supose one of the Frames has done half the work that has been done.

"6. I don't apprehend that the Wheels and Pinions of that Frame are half worn out: from whence I infer, that a set of Wheels and Pinions would spin at least 35,000 skeins. That is 100 Wheels and 100 pinions.

"7. The rest of the work belonging to that Frame, taken in general, is not (in my opinion) one tenth part worn out.

"8. Joseph Newton (a man that has always been employed in the work since it first began at Birmingham) would undertake to keep the 250 spindles in repair with his own hands; i. e. metal work, estimating at the rate they have worked.

"9. The metal itself, and the wood-work, cannot, in my opinion, exceed £20 per annum.

"10. I call the insensible decay of the *Mill*, Building, and *Water Wheel*, about £20 per annum more.

"11. The repairs of *Cards*, they tell me, amounts to 18d. per week: which is about eaqual to the wages of the Carders themselves, but much more than I think they cost at Birmingham: that is, per week.

"12. The cards, and carding, both extremely ill managed.

"13. The work never clean'd, till necessity forces a particular *spindle*.

"14. The dirt and cotton spread about the spinning-rooms, and the pathways near the mill, is surprising.

"15. The Agent there has his wife, and two other women, to assist him; whose salary's taken together, (I am told,) amounts to about £88 per annum.

"16. The Water Wheel is capable of making about 15 revolutions in a minute; but they generaly flood it, in tail, till it makes but about 6 or 8 revolutions in a minute.

"17. Their picking Cotten, and reeling Yarn, amounts to about 1d. per lb.

"18. They have fifty Carders, Spinners, and Supernumerary Girls in the work; whose wages, last week, amounted to £2. 19s. 7d. (which I will call £3.)

"19. I apprehend they waste about one-tenth part of the Cotten.

"20. The sort of Yarn they spin is about 15 skeins per lb.

"Their Cards much to fine for the sort they spin.

"February, 1743-4.

"22. Since the taking of the remarks above, I have been informed, by an author that I can depend upon, that they have spun half as much more in a week as they did when I was there; and that in particular the day before my letter's date, one pair of girls spun 36 skeins.

"23. That the repairs of cards do still cost them about as much as the carders that card with them."

In this MS. book there are some particulars concerning the prices of Lancashire and East India yarns, in 1739, 1740, 1742, and 1743, collected by Mr. Wyatt, during a residence in London, and in the course of a journey into Lancashire, which will be read with interest by all connected with the cotton trade, as being the most distinct and authentic information now existing on the subject. It shews that East India yarns were then commonly used in this country for the finer kinds of goods. The following is Mr. Wyatt's statement of the results of his inquiries:—

"In the year 1739 and 1740, I was allmost daily at Mr. Johnson's, in Spittlefields,* London, where it was often necessary for

* "An eminent weaver there."

him to shew me his yarns, of about 16, 20, or 24 skeins per lb., some of which, he told me, cost him about 2¼d. per skein; but the lowest price that ever I remember to have heard him mention was about seven farthings and half farthing. I remember, too, that the lowest prised yarns was generaly toward the latter part of the time that I was at his house. And likewise, that I sometimes took the liberty, as oppertunity favour'd, to ask the same question of the stock-taker, as I had done of the master, and generaly found that the man suppos'd a higher price upon the yarns than the master himself. As there was various ways of buying yarn, sometimes by the skein, sometimes by the lb., and sometimes by the dozen, and sometimes by the bundles; it seldom happened that the [price of the] Lancashire skein would be in even farthings.

"In June, 1742, Mr. Yeomen* introduced me to one Mr. King, a cap-maker, in Aldersgate street, London, who told us, that he at that time gave 3s. 9d. per lb. for yarn of about 20 skein per lb., which yarn he shew'd us. About Michaelmas, 1743, Mr. Yeomen and I paid him another visit: he now seem'd much inclin'd to have some of our spinning,† or to let us have some wool to spin. He now told us that he had lately bought a parcel of yarn for seven farthings per skein; but upon canvasing his words, he explained himself thus;—I gave 3s. bateing a penny per lb., and it runs from 16 to 20, but most of it is 20. Mr. Yeomen seem'd perfectly well acquainted with him, and look'd upon him as a mighty fair, honest man, and must own he appear'd so to me. He is said to deal for about £50 per week.

"Birmingham, 1743:—In conversation with Mr. Henry Morris,‡ and Mr. Bourn,§ at the Castle Inn, I haveing acknowledg'd my deficiency in the price of yarns, and inquireing of Mr. Morris; he declin'd perticulars; pretending he could not so well answer me that, there were such great variety; but I know, (says he,) that we give a penny a hank for spinning. N.B. Hank is another word for skein.

* "Who erected Mr. Cave's work at Northampton."

† "That is to be spun by the engine, either at Birmingham or Northampton."

‡ "A Lancashire dealer."

§ "At this time negociating a parthership with Mr. Morris."

"By an enquiry of Mr. Rowe,* am told (at Xmas.) that coarse yarns, vizt. of about 12 skein per lb. had very lately been advanced from 10d. per lb. to 14d., that is from 2d. under, to 2d. above a penny a skein, spinning.

"Mr. Touchet, sen.,† tells me, that their people have, within these two years, spun as much for 8d. as they now do for a shilling; adding, that they had had coarse yarns spun for three farthings per skein. Though (continued he) we give a penny a hank for all above twenty-four. I then asked him if they did not give more than a penny a hank if it should be twice twenty-four? He answered no. Adding, but we seldom have any so fine, though I have heard of some to sixty in the country. He thought their yarn of 5s. per lb. spinning, was as fine as the East India yarn of 12s. or 12s. 6d. per lb., though he knew that Mr. Johnson‡ had bought the last lott exceeding cheap. He tells me, they allow 1d. per lb. for reeling; that the best cotton in the world is that of Jamaica.

"Mr. James Livesey,§ the same day, tells me, that their people could work twenty per cent. cheaper; nay, he questioned, if they would not work thirty per cent. cheaper, before they would loose their business.—He declared he would answer me any question that I could ask him. I then (or indeed immediately before his declaration) signified my want of knowledge in the value of yarns. He then told me that they now gave 1d. per lb. more than they did some time ago.

"Within this twelvemonth, they had course yarn spun for 2d. per lb. abate; and now they abate one penny per lb., of a penny a skein, to about twenty skeins per lb. He could not, or pretended he could not, tell me what they now gave for the finer sort, as from twenty-four to forty, telling me they used but little of that. On my desireing to see some of his yarn, he told me he had no yarn by him, for that all their work was done in the country. But immediately reached me several pieces of white goods, (not bleached,) one of which he told me he sold for about £100 per pack, and he supposed the weft to be about 40 hanks per lb. He could not tell

* "An eminent dealer in Birmingham."

† "An eminent dealer in Manchester."

‡ "Meaning the same Mr. Johnson as above."

§ "Another very considerable dealer in Manchester."

me to what character of fineness, was the finest he had ever heard of; but believed that the East India Company had sold yarn for 40s. per lb.

"He acknowledged, that though they gave but a penny a skein to the spinners, yet the great number of servants and agents that they were obliged to have about the country, made their yarn stand them in five farthings per skein. Mr. Morris likewise told me, that they had yarn at a guinea per lb., spinning. And I think Mr. Johnson used to tell me, that he gave about 13s. or 14s. per lb. for a sort of East India yarn, of which he used great quantities. It was not usual to reel this yarn; but Mr. Johnson, senior, told me, that he had sometimes reeled a little, for curiosity, and found it to run about 60.*

"I apprehend it may reasonably be infer'd, from Mr. Johnson, and Mr. King, &c.[a] that the price of yarn of about 20 skein per lb. may be generally about 2d. per skein. Tho my estimate supposes the mean rate 6¼ per cent. cheaper, vizt. 7½ farthings. Without laying too much stress on Mr. Livesy's authority, that the 20 skein yarn stands the manufacturers in five farthings per skein, I think it may be granted that they would be glad to give upwards of a penny. That a penny a skein is near the general price given to the spiners, is confirm'd to me by a great number of them, being all in the same assertion.

"The price of fine yarns seems so unsettled among them, that it in some measure pleads an excuse for Mr. Livesey's, and Touchet's shyness, in their answers on that account; for I found, among the spiners, that the price of 40 skein yarn varied from 4s. 2d. to 6s. 8d. per lb. spining; and, from about 50 ty's to 60 ty's, the price was from 8s. to about 13s. And one spiner I found [Wiggan] that had had 20s. 6d. per lb. for some, which reel'd to about 80 ty's. But these prices don't vairy according to certain periods of time, as they seem to do in the course yarn; but according to places, and masters, and other circumstances, so that when the coarse yarn may be dearer, the fine may be cheaper, which seems in some measure the present case."

* "I apprehend (though I cannot perfectly recollect) that this yarn, which reel'd to 60, was not the identical yarn which cost 13s. or 14s. per lb.; but that it was meant that the East India was not commonly reel'd."

If Wyatt could have applied himself as closely to the perfecting and direction of his machinery, and to the arrangements in his mill, as Arkwright afterwards did—finding some one to make known and dispose of his yarn—the great impetus to the cotton manufacture might have been given thirty years earlier.

We come now to quote the important testimony of Mr. Charles Wyatt to his father's claims as the inventor of the spinning machine. The letter contains a highly interesting narrative, and it is characterised by a modesty and candour which do honour to the writer. This document was published in the "Repertory of Arts, Manufactures, and Agriculture," for January, 1818, then edited and published by his brother, Mr. J. Wyatt:—

"*Bedford Row, November* 15*th*, 1817.

"Dear Brother,

"In compliance with your request, I send you some account of the origin of the present method of spinning by machinery, for insertion in the Repertory of Arts and Manufactures, which being a receptacle of useful knowledge, nothing can with more propriety fill up a part of its columns. Our chief view, however, in this is, to rescue from oblivion, and affix the gratitude of a nation upon a name dear to us, and unknown to those who are exalted, though perhaps unconsciously, by his genius: our parent, John Wyatt, of Birmingham.

"To produce something out of nothing is a greater effort of excogitation, than to improve what is already produced.

"The production, then, of a system of machinery to supersede the artless method of spinning with the fingers, may be justly classed among the highest efforts of mechanical combinations; and this was accomplished early in the last century, by the individual here spoken of.

"The brief history of the invention, which my superior years, and the circumstance of my being in possession of his papers and

memorandums on the subject, gives me an advantage over you, as far as I am able to trace it, is this: In the year 1730, or thereabouts, living then at a village near Litchfield, our respected father first conceived the project, and prepared to carry it into effect; and in the year 1733, by a model of about two feet square, in a small building near Sutton Coldfield, without a single witness to the performance, was spun the first thread of cotton ever produced without the intervention of the human fingers,—he, the inventor, to use his own words, '*being all the time in a pleasing but trembling suspense.*' The wool had been carded in the common way, and *was passed between two cylinders, from whence the bobbin drew it by means of the twist.*

"This successful experiment induced him to seek for a pecuniary connexion equal to the views that the project excited; and one appeared to present itself with a Mr. Lewis Paul, which terminated unhappily for the projector; for Paul, a foreigner, poor and enterprising, made offers and bargains which he never fulfilled, and contrived, in the year 1738, to have a patent taken out in his own name for some additional apparatus; a copy of which I send you:* and in 1741 or 1742, a mill, turned by two asses walking round an axis, was erected in Birmingham, and ten girls were employed in attending the work. Two hanks of the cotton then and there spun are now in my possession, accompanied with the inventor's own testimony of the performance. Drawings of the machinery were sent, or appear to have been sent, to Mr. Cave, for insertion in the Gentleman's Magazine.†

"This establishment, unsupported by sufficient property, languished a short time, and then expired: the supplies were exhausted, and the inventor much injured by the experiment, but his confidence in the scheme was unimpaired. The machinery was sold in 1743. A work upon a larger scale, on a stream of water, was established at Northampton, under the direction of a Mr. Yeomen, but with the property of Mr. Cave. The work contained 250 spindles, and employed fifty pair of hands. The inventor soon after examined the state of the undertaking, and found great defi-

* The patent, though sent for publication, was not published in the "Repertory," and to this it is probably owing that Mr. Charles Wyatt's letter produced no effect on the public mind, being unaccompanied by the decisive proof contained in the patent itself.

† They were not inserted.

ciency and neglect in the management. At that time they had spun about 3300lbs. of cotton. On the observations which he then made, he composed what he entitled 'A Systematic Essay on the Business of Spinning,' which exhibits a clear view of the mechanical considerations on which an undertaking of that nature, of whatever magnitude, must be established, and apparently confines his humble pretensions to the profit on 300 spindles. It was not within human foresight to calculate the richness of the harvest to come from this little germ.

"This brings me to the conclusion of our father's connexion with the spinning business.

"The work at Northampton did not prosper. It passed, I believe, into the possession of a Mr. Yeo, a gentleman of the law in London, about the year 1764, and, from a strange coincidence of circumstances, there is the highest probability, that the machinery got into the hands of a person, who, with the assistance of others, knowing how to apply it with skill and judgment, and to supply what might be deficient, raised upon it by a gradual accession of profit an immense establishment and a princely fortune.

"In the year 1739, my father writes to one of his friends, '*that by this method*,' some new thought, '*the wool need be no more carded than to break the knots or mix it well, as with scribbles or stock cards, and being thus mixed, and pressed down hard into a box, it may, without any human touch, be picked out almost hair by hair, and made into yarn.*'

"In 1748, Mr. Paul procured another patent, the title of which was '*for carding of wool and cotton*;' but whether this was combined with the machinery then at Northampton, or where it was introduced, I know not. Such, or nearly such, being the early history of this invention, I thought the late Sir Richard Arkwright would be gratified by possessing the very model to which I have alluded; and I accordingly waited on him at Cromford with the offer, but my reception did not correspond with my expectations.

"To pretend, however, that the original machinery, without addition or improvement, would alone have produced the prodigious effects which we now behold, would be claiming improbable merit for the inventor, and degrading the talents and sagacity of his successors in the same field of enterprise; for it cannot be denied,

that a great fund of ingenuity must have been expended in bringing the spinning works to their present degree of perfection. The number of spindles now in use is supposed to exceed five millions.

"If the author of the humble establishment at Birmingham gave birth to such a wonderful progeny, he ought at least to be acknowledged as a benefactor to his country, and recorded amongst the men who, from an attachment to the sciences and practice of mechanics, open the paths of knowledge, and point out, but do not pursue, those which lead to profit and prosperity.

"Connected with this subject, I might, with great propriety, point out many eminent services that he rendered the public by his mechanical talents; but, being mostly local, and absorbed by subsequent productions, they have lost their present interest.

"The machine, however, for weighing loaded carriages, coal particularly, ought to be distinguished as one of known and extensive utility. It was solely, and exclusively, his own; he erected the first at Birmingham, about fifty years ago, and his own description of it is, *That it would weigh a load of coal, or a pound of butter, with equal facility, and nearly equal accuracy.* The present makers admit, that the principle is incapable of improvement.

"The late Mr. Boulton, a man too eminent and too amiable to be mentioned without esteem and regret, nor on my part without affection, set a high value both on my father's attainments and virtues: for it was universally acknowledged, that he had the happiness to give a lustre and an interest to his genius and his knowledge, by the purest probity, the most unaffected humility, urbanity, and benevolence. He was attended to his grave, in 1766, by Mr. Boulton, Mr. Baskerville, the celebrated printer, (who, from the peculiarity of his notions, arrayed himself on this occasion, in a splendid suit of gold lace,) and four other gentlemen of eminence in Birmingham.

"I am, dear Brother, yours affectionately,

"CHARLES WYATT."*

* I learn from Mr. Kennedy the fact, that this letter was published in consequence of the reading of his paper before the Literary and Philosophical Society

Mr. Boulton, of Soho, Birmingham, (who is mentioned in the last paragraph,) the celebrated partner of James Watt in the manufacture of the steam-engine, had seen the spinning-machine at Birmingham, when a boy, and assured Mr. Kennedy that he considered Wyatt as the inventor. I have further confirmation of this fact from Mr. Walter Henry Wyatt, of Southwark, (the grandson of Mr. John Wyatt,) who, on being applied to by me for any further evidence the family might have concerning the invention, wrote as follows:—

"I am convinced of the fact of the invention being my grandfather's, from the evidence of the late Mr. Matthew Boulton, who a short time previous to his death, called on me— the first and only time I ever saw that gentleman—and in the course of conversation upbraided, or, I may rather say, condoled with me on the neglect of his sons in claiming the invention."

Having thus proved that the *principle* of Wyatt's invention was the same as that of the spinning frame brought into use by Arkwright, I must add, that the *details* of the Birmingham machine were far from being perfect, and that the machine differed greatly from Ark-

of Manchester, "On the Rise and Progress of the Cotton Trade." It happened that a young lady, a great-grandchild of Mr. Wyatt, was on a visit at Mr. Kennedy's house at the time; and, hearing of the subject of his paper after it had been read, and finding, on perusal of the paper, that it contained no reference whatever to her great-grandfather's claims as the inventor of the spinning-machine, (which she knew by family tradition,) she informed her uncle, Mr. Charles Wyatt, of the fact, and he in consequence published this important letter. Mr. Kennedy copied a portion of the letter as a note to his paper, when published in the Memoirs of the above Society, but (not having seen the patent itself) he was not then, as will appear from an extract we have previously made from this Note, fully convinced that Wyatt's machine was the original of Arkwright's. Subsequently the perusal of the patent of 1738, and further inquiry, have convinced him that the two machines are identical in principle.

wright's in its form and construction. That it was imperfect appears manifest from its having failed to become profitable. It was tried by Wyatt and Paul at Birmingham between 1738 and 1743; an engine of a similar kind was erected in the latter year at Northampton, with capital supplied by Mr. Cave; and so late as the year 1758 we find Lewis Paul taking out a new patent for the spinning machine, with some improvements; yet none of these succeeded. This lingering existence of the invention leads me to suppose that it was not uniformly unprofitable, but that the profits were small, and generally more than swallowed up by the expenses. The proprietors saw that they were in possession of a great and valuable principle; but, probably from deficiency of capital, and from the want of continued application on the part of Wyatt to the perfecting of the details, it yielded no fruit to him whose happy genius first conceived so admirable a process.

As the patent of 1738 contains no detailed description of the machine, and as the model spoken of by Mr. Charles Wyatt has been lost or destroyed, we cannot ascertain what was the construction of this first machine for spinning by rollers. Paul's patent of 1758, however, may materially help us in our conjectures, especially as all the notices of the machinery contained in the MS. book above quoted seem to indicate an engine of the same kind. The latter patent is remarkably complete in its drawings and specification; and from a careful inspection of them I think it highly probable that the machine was essentially the same as the original spinning machine of 1738, but included a supposed improvement in the mode of applying the sliver of cotton

to the rollers, consequent upon Paul's improvement in the carding process, hereafter to be described.

The specification of the patent of 1758* contains the following general description of the process:—

"The wooll or cotton to be spun by the said machine or engine must be first carded upon a card made up of a number of parallel cards, with intervening spaces between each; and the matter so carded must be taken off each card separately. The several rowes or fillaments so taken off must be connected into one entire roll, which, being put between a pair of rollers or cylinders, is by their turning round delivered to the nose of a spindle, in such proportion to the thread made as is proper for the particular occasions. From hence it is delivered to a bobbin, spole, or quill, which turns upon the spindle, and which gathers up the thread or yarn as it is spun. The spindle is so contrived as to draw faster than the rollers or cylinders give, in proportion to the length of thread or yarn into which the matter to be spun is proposed to be drawn."

The annexed plate, (Pl. 2.) which contains two views of the machine, taken from the drawings accompanying the specification, will assist the reader to form an idea of its construction. It will be observed, that the machine contains only one pair of rollers: the patent of 1738 expressly describes two pairs, the second moving faster than the first; but it adds that in some cases only the first pair of rollers was used. In the second patent, the upper roller was called the "riband cylinder," from the sliver, or carding, being wound upon it by means of a riband: as the cylinder turned, the sliver came off, was compressed between the two cylinders, and then, being

* In this specification, the patentee is styled "Lewis Paul, of Kensington Gravel Pitts, in the county of Middlesex, Esquire." One of the witnesses is Mr. Thomas Yeo; probably the same gentleman into whose hands Mr. Charles Wyatt states that the work at Northampton passed about the year 1764.

delivered to the nose of the spindle, was at once drawn out, (so as to reduce it in thickness,) twisted into a thread, and wound upon the bobbin. The interior of the machine contained much ingenious and complex wheel-work;—the larger wheels being of wood, and the smaller of metal, finished like clock-work: the whole was moved by the upright shaft in the centre, which was turned by the water-wheel.

A comparison of this machine with that of Arkwright, of which the specification drawing will shortly be given, shows that there is a great difference in the construction of the two. So far is the one from being a copy of the other, that that of Arkwright indicates great inventive talent, even if we suppose that he had seen the former machine; but the mechanical details of the two have so little in common, that I am induced to think, contrary to the opinion of Mr. Charles Wyatt, that Arkwright had not seen the machine of Wyatt or Paul. It must, however, be admitted, that to contrive and adjust the details of such a machine, though of the greatest practical importance, is a merit very subordinate to that of him who conceived the great principle. The latter is the glory of Wyatt. How much Arkwright owed to his predecessor can only be matter of conjecture; that he thus learnt the principle of spinning by rollers, I am convinced; and, as will soon appear, another individual besides Wyatt puts in his claim to precedency of Arkwright. The latter unquestionably knew of the attempts to spin cotton by machinery at Birmingham and Northampton, and of *the patent* of 1738, which describes the two pairs of rollers, as he himself declares as much in the "Case" which he drew up to be presented to parliament in 1782. He says—"About 40 or 50 years ago, one Paul, and

others, of London, invented an engine for spinning of cotton, and obtained a patent for such invention; afterwards they removed to Northampton and other places. They spent many years and much money in the undertaking, but without success; and many families who had engaged with them were reduced to poverty and distress."

Arkwright, therefore, knew the history of Paul and Wyatt, and knew of the patent; and though it is not certain that he had this knowledge before he constructed his own machine, yet the fact of his possessing it at a later period strengthens the probability of his having, at least, heard of the machine for spinning by rollers, before he made his own. This conjecture is still further favoured by the repulse which he gave to Mr. Charles Wyatt, when the latter waited upon him with the original model of the spinning machine.*

I have compared the doubts which hang over the history of the cotton spinning inventions, with those in which the origin of that still nobler art, the art of printing, is involved. The claims of Wyatt are indeed nearly as well established as those of Gutenberg; and Paul may have been auxiliary to the first cotton spinner, as Faust was to the first printer. Yet, as a claim is set up for Lawrence Coster to the invention of types and printing, and supported by evidence which it is difficult wholly to

* When I first read the patent of 1738, I was so struck with its exact description of the process of spinning by two pairs of rollers, one pair moving faster than the other, that I too hastily concluded the machine thus generally described to be the original of Arkwright's, not only in its principle, but in its construction and details. An attentive consideration of the machine for which a patent was obtained in 1758, and of Wyatt's incidental notices of the first machine in his MS. Essay on the Business of Spinning, together with a comparison between these and the machine of Arkwright, considerably modified my opinion.

invalidate or to account for; so there is another claimant (besides Arkwright) to the honour of inventing the spinning rollers, whose pretensions ought not to be treated with contempt. I allude to Thomas Highs,* reed maker, of Leigh, whose claims have been maintained with great zeal by Mr. Guest, in his History of the Cotton Manufacture, and his Reply to an article in the Edinburgh Review. This author contends that Highs was the inventor not only of the water-frame brought into use by Arkwright, but also, a few years earlier, of the jenny, a spinning machine on a different principle, commonly ascribed to James Hargreaves.† As I have been led by the order of events first to discuss the invention of spinning by rollers, I shall at present confine my remarks to the evidence that such a mode of spinning was devised by Highs, and shall afterwards return to the history of the spinning jenny.

In the trial which took place, in the court of King's Bench, on the 25th of June, 1785, to try the validity of Mr. Arkwright's patent, Highs gave evidence to the following effect:—That he himself made rollers, for the purpose of spinning cotton, in the year 1767, (Arkwright's first patent being only taken out in 1769;) that in his machine there were two pairs of rollers, the second revolving five times as fast as the first; that this was for the purpose of drawing the thread finer; that it was used both to spin and to rove; that he at first only used two spindles; that he did not follow up his invention, from the want of pecuniary means, but intended to keep it

* In Arkwright's Trial, and in several other works, the name is spelt *Hays*; but Mr. Guest says it is written *Highs* in Leigh church register, and is so pronounced by his family and the neighbourhood.—Reply, p. 18.

† Guest's Hist. of the Cotton Manufacture, pp. 12, 16.

secret till he could procure assistance. He stated, that he communicated his invention to one Kay, a clock-maker, whose aid he required to make him a small model of the machine with brass wheels. He also added, that, having once met Arkwright at Manchester, after the latter had taken out his patent for the water-frame, he (Highs) reproached him with having got his invention, which Arkwright did not deny.

In confirmation of Highs's claim, John Kay, the clockmaker,* gave evidence to the court, that he made the wheels and rollers for Highs at the time alleged; that he the same year, or early in the year following, communicated the plan to Arkwright, who was then a poor man, and, at his request, he made him two models; that Arkwright engaged him (Kay) to accompany him, first to Preston and afterwards to Nottingham, where he remained in his service four or five years, and then quitted him, having been unjustly accused of felony. Kay's wife spoke generally to the same facts, but with so much vagueness, and such an utter confusion of dates, that her testimony cannot be relied upon.

The claim thus distinctly made by Highs, and supported by Kay, is stated by Mr. Guest to be generally received as true in Leigh, the town where Highs resided. Mr. Bearcroft, the counsel against Arkwright on the trial, said the same thing in 1785: "It is a notorious story (said he) in the manufacturing counties; all men

* According to Mr. Guest, Kay lived at Leigh when he was employed by Highs, but soon afterwards removed to Warrington, where he dwelt when Arkwright called upon him.—Hist. of the Cotton Manufacture, p. 17.—This is confirmed by the statement of Thomas Leather and other old persons, who knew Kay when living at Leigh.

that have seen Mr. Arkwright in a state of opulence, have shaken their heads, and thought of these poor men, Highs and Kay, and have thought too that they were entitled to some participation of the profits." The fact that the clockmaker, who had made wheels for Highs, was taken by Arkwright to Nottingham, and kept there for some years, affords considerable confirmation to the story. Nor can any motive be conceived why Kay should falsely set up a claim for a poor man like Highs, unable to bribe him. It is also stated by those who personally knew Highs, that he was a conscientious and religious man, very unlikely to perjure himself. His mechanical ingenuity is proved by his having exchanged his original trade of a reed-maker for that of a maker of spinning machines; and also by two facts stated by Mr. Guest, namely, that he received a present of two hundred guineas from the manufacturers of Manchester, in 1772, for a very ingenious invention of a double jenny, which was publicly exhibited in the Exchange; and that he afterwards went to construct spinning machines at Nottingham, Kidderminster, and in Ireland.*

It must be admitted, however, that there are circumstances of great weight to oppose to the claim of Highs. He not only took out no patent, (which his circumstances prevented,) but he never completed any machine, so as to set it on work, till long after Arkwright had obtained

* Guest's Reply, pp. 203, 205, 206. Dr. Aikin also says—"The roller upon which Mr. Heys's (Highs's) spindle-strings ran was immediately adopted after his public exhibition of it; his contrivance also of slipping his handle from a square to a round, which checked the operation of spinning, and pushing on to an interior contrivance to wind up the spun thread, is adopted in the machines for spinning of twist."—Hist. of Manchester, p. 171.

his patent. He never *publicly* laid claim to the invention till 1785,* eighteen years after he is said to have made the machine. He never shewed the model made for him by Kay, in proof of his being the inventor. No witness but Kay speaks to his having made such a machine. No document attests it. Dr. Aikin and Mr. Guest are the only authors who assert it.† Kay, the only witness besides Highs himself, had quarrelled with and quitted Arkwright, and was therefore prejudiced against him; to say nothing of the charge of felony, as to the truth of which there is no evidence.

Such a case is far from satisfactory. It is possible that the imperfect invention of Highs included the principles of the water-frame; but if so, it is remarkable that the evidence of it should be so scanty and defective. When it is considered, too, how many projects have floated through the brains or perished in the hands of inventors, we naturally require strong proof in support of Highs's claims to this important invention. Still there is some evidence, which it is difficult to dispose of. The case becomes more perplexed when it is remembered that a machine on the same principle as that

* Highs and Kay were, however, in attendance at a previous trial in 1781, when Arkwright brought an action against colonel Mordaunt for the invasion of his patent; but they were not called upon to give evidence, the plaintiff being defeated on another ground. See Mr. Erskine's statement on the trial in 1785.—Trial, p. 66.

† Dr. Aikin appears to have taken his account from the evidence of Highs and Kay on the trial. Highs's claim is not mentioned by Mr. Kennedy, by Mr. Dugald Bannatyne, author of the able article on the "Cotton Manufacture" in the Supplement to the Encyclopædia Britannica, or by the author of the article on the same subject in Rees's Encyclopædia; and it is strenuously controverted by Mr. M'Culloch in his article on the "Rise, Progress, Present State, and Prospects of the British Cotton Manufacture," in No. 91 of the Edinburgh Review.

which was unfinished in the hands of Highs, had beyond all question been completed, made the subject of a patent, and set to work thirty years before by Wyatt.

One conjecture may furnish a clew to extricate us from the labyrinth: it is possible that Highs may have heard the rumour of Wyatt's invention, may have imitated it, and may thus have become the channel through which the knowledge of the invention was conveyed to Arkwright.

CHAPTER IX.

INVENTIONS IN SPINNING MACHINES.

Sir Richard Arkwright; his humble origin; his construction of a machine for spinning by rollers; his settlement at Nottingham; partnership with Messrs. Strutt and Need; his first patent for the spinning machine.—James Hargreaves invents the spinning jenny; his machine broken by a mob; riots against machinery; Hargreaves retires to Nottingham; his subsequent history.—Effects of the spinning machines on the cotton manufacture.—Calicoes first manufactured in England by Arkwright.—Opposition of the Lancashire manufacturers to Arkwright, and to the new manufacture.—Parliament sanctions British calicoes.—Other improvements in the spinning machinery.—Carding; the old methods; the carding cylinder invented by Lewis Paul in 1748.—Subsequent improvements in the carding engine by Arkwright and others.—Drawing frame.—Roving frame.—Arkwright's second patent for carding, drawing, and roving machines.—Great extension of the manufacture.—Rise of the factory system; its advantages.—Dr. Darwin's poetical description of a cotton mill.—Arkwright's great success stimulates envy and opposition.—His patent infringed.—Trial.—Arkwright's "Case."—Second and third trials.—The patent declared null.—Arkwright's subsequent career; he is knighted; his death; his character.

In pursuing the history of spinning by rollers, we come now to the successful introduction of that invention by sir Richard Arkwright, who, though not entitled to all the merit which has been claimed for him, possessed very high inventive talent, as well as an unrivalled sagacity in estimating at their true value the mechanical contrivances of others, in combining them together, perfecting them, arranging a complete series of machinery, and constructing the factory system—itself a vast and admirable machine, which has been the source of great wealth, both to individuals and to the nation.

Richard Arkwright rose by the force of his natural talents from a very humble condition in society. He was born at Preston on the 23d of December, 1732, of poor parents: being the youngest of thirteen children, his parents could only afford to give him an education of the humblest kind, and he was scarcely able to write. He was brought up to the trade of a barber at Kirkham and Preston, and established himself in that business at Bolton in the year 1760. Having become possessed of a chemical process for dyeing human hair,* which in that day (when wigs were universal) was of considerable value, he travelled about collecting hair, and again disposing of it when dyed. In 1761, he married a wife from Leigh, and the connexions he thus formed in that town are supposed to have afterwards brought him acquainted with Highs's experiments in making spinning machines. He himself manifested a strong bent for experiments in mechanics, which he is stated to have followed with so much devotedness as to have neglected his business and injured his circumstances. His natural disposition was ardent, enterprising, and stubbornly persevering: his mind was as coarse as it was bold and active, and his manners were rough and unpleasing.

In 1767, Arkwright fell in with Kay, the clockmaker, at Warrington, whom he employed to bend him some wires, and turn him some pieces of brass. From this it would seem that Arkwright was then experimenting in mechanics; and it has been said, that he was endeavouring to produce perpetual motion.† He entered into

* I have no means of knowing whether this secret was a discovery of his own, or was communicated to him. Mr. Guest says, he "possessed" the secret; Mr M'Culloch, that he "discovered" it.

† Aikin and Enfield's General Biography, Vol. I. p. 891.

conversation with the clockmaker, and called upon him repeatedly; and at length Kay, according to his own account, told him of Highs's scheme of spinning by rollers. Kay adds, in his evidence, that Arkwright induced him to make a model of Highs's machine, and took it away. It is certain that from this period Arkwright abandoned his former business, and devoted himself to the construction of the spinning machine; and also, that he persuaded Kay to go with him first to Preston, and afterwards to Nottingham, binding him in a bond to serve him at a certain rate of wages for a stipulated term. The particulars of what passed between Arkwright and Kay rest wholly on the evidence of the latter; but there is no doubt that Kay was thus engaged to accompany Arkwright, and that he worked for him some time at Nottingham. Those who believe in the invention of Highs find in this fact, combined with Highs's own evidence, a very strong presumption in its favour: but those who disbelieve it may adopt the conjecture, that Arkwright, not being a practical mechanic, engaged the clockmaker to construct the apparatus he had himself contrived. The statement of Arkwright, in the "Case" drawn up to be submitted to parliament, was, that "after many years' intense and painful application, he invented, about the year 1768, his present method of spinning cotton, but upon very different principles from any invention that had gone before it." It is true that Arkwright had been experimenting in mechanics, but there is no evidence to shew that he had ever thought of making a spinning machine before his interview with Kay at Warrington.

Kay appears not to have been able to make the whole machine, and therefore "he and Arkwright applied to

Mr. Peter Atherton, afterwards of Liverpool," (then probably an instrument maker at Warrington,) "to make the spinning engine; but from the poverty of Arkwright's appearance, Mr. Atherton refused to undertake it, though afterwards, on the evening of the same day, he agreed to lend Kay a smith and watch-tool maker, to make the heavier part of the engine, and Kay undertook to make the clockmaker's part of it, and to instruct the workman. In this way Mr. Arkwright's first engine, for which he afterwards took out a patent, was made."*

Being altogether destitute of pecuniary means for prosecuting his invention, Arkwright repaired to his native place, Preston, and applied to a friend, Mr. John Smalley, a liquor-merchant and painter, for assistance. The famous contested election, at which General Burgoyne was returned, occurring during his visit, Arkwright voted; but the wardrobe of the future knight was in so tattered a condition, that a number of persons subscribed to put him into decent plight to appear at the poll-room. His spinning machine was fitted up in the parlour of the house belonging to the Free Grammar School, which was lent by the head-master to Mr. Smalley for the purpose.† The latter was so well convinced of the utility of the machine, that he joined Arkwright with heart and purse.

In consequence of the riots which had taken place in the neighbourhood of Blackburn, on the invention of Hargreaves's spinning jenny in 1767, by which many of

* Aikin and Enfield's "General Biography," Vol. I p. 391. The authors profess to have obtained some of these facts from private sources; and Dr. Aikin's opportunities were good, as he resided at Warrington.

† These facts are stated on the authority of Nicholas Grimshaw, Esq. several times mayor of Preston, who has personal knowledge of them.

the machines were destroyed, and the inventor was driven from his native county to Nottingham, Arkwright and Smalley, fearing similar outrages directed against their machine, went also to Nottingham, accompanied by Kay. This town, therefore, became the cradle of two of the greatest inventions in cotton spinning. Here the adventurers applied for pecuniary aid to Messrs. Wright, bankers, who made advances on condition of sharing in the profits of the invention. But as the machine was not perfected so soon as they had anticipated, the bankers requested Arkwright to obtain other assistance, and recommended him to Mr. Samuel Need, of Nottingham. This gentleman was the partner of Mr. Jedediah Strutt, of Derby,* the ingenious improver and patentee of the stocking-frame; and Mr. Strutt having seen Arkwright's machine, and declared it to be an admirable invention, only wanting an adaptation of some of the wheels to each other, both Mr. Need and Mr. Strutt entered into partnership with Arkwright.

Thus the pecuniary difficulties of this enterprising and persevering man were terminated. He soon made his machine practicable, and in 1769 he took out a patent. In the specification, which was enrolled on the 15th of July in that year, he stated that he "had by great study and long application invented a new piece of machinery, never before found out, practised, or used,

* Mr. Strutt was brought up a farmer, but, having a passion for improvement and a mechanical genius, he succeeded in adapting the stocking-frame to the manufacture of *ribbed* stockings, for which improvement he obtained a patent. He established an extensive manufacture of ribbed stockings at Derby, and, after his connexion with Mr. Arkwright, he erected cotton works at Milford, near Belper: he raised his family to great wealth. Some of the circumstances connected with Arkwright's settling at Nottingham, were communicated by the late Mr. William Strutt, the highly gifted and ingenious son of Mr. Jedediah Strutt, to the editor of the Beauties of England and Wales. See vol. iii. pp. 518, 541.

for the making of weft or yarn from cotton, flax, and wool: which would be of great utility to a great many manufacturers, as well as to his Majesty's subjects in general, by employing a great number of poor people in working the said machinery, and by making the said weft or yarn much superior in quality to any ever heretofore manufactured or made."

The importance of this machine requires that Arkwright's own description of it in his specification should be given, which is illustrated by the annexed plate, (*Pl. 3, fig. 2.*)

"Now know ye that I, the said Richard Arkwright, do hereby describe and ascertain the nature of my said invention, and declare that the plan thereof drawn in the margin of these presents is composed of the following particulars, (that is to say) A, the Cogg Wheel and Shaft, which receive their motion from a horse. B, the Drum or Wheel which turns C, a belt of leather, and gives motion to the whole machine. D, a lead weight, which keeps F, the small drum, steady to E, the forcing Wheel. G, the shaft of wood which gives motion to the Wheel H, and continues it to I, four pair of Rollers, (the form of which are drawn in the margin,) which act by tooth and pinion made of brass and steel nuts fixt in two iron plates K. That part of the roller which the cotton runs through is covered with wood, the top Roller with leather, and the bottom one fluted, which lets the Cotton, &c. through it; by one pair of Rollers moving quicker than the other, draws it finer for twisting, which is performed by the spindles T. K, the two iron plates described above. L, four large Bobbins with cotton rovings on, conducted between Rollers at the back. M, the four threads carried to the Bobbins and Spindles by four small wires fixt across the frame in the slip of wood V. N, iron leavers with small lead weights hanging to the Rollers by Pulleys, which keep the Rollers close to each other. O, a cross piece of wood to which the leavers are fixed. P, the Bobbins and Spindles Q, Flyers made of wood, with small wires on the side, which lead the thread to the bobbins. R, small worsted bands put about the whirl of the bobbins, the

screwing of which tight or easy causes the bobbins to wind up the thread faster or slower. S, the four whirls of the spindles. T, the four Spindles, which run in iron plates. V, explained in letter M. W, a wooden frame of the whole machine."

Such is the original of the present water-frame and throstle. It was afterwards greatly improved by Arkwright himself; and, when horse-power was exchanged for water-power, the number of spindles in the frame was multiplied. The original machine was adapted only to perform the last operation in spinning, namely, reducing the rovings into yarn; but it was easily applicable to the process of roving itself, as will subsequently appear. It is remarkable that the inventor, in his application for a patent, described himself as "Richard Arkwright, of Nottingham, *clockmaker*."* He and his partners erected a mill at Nottingham, which was driven by horses; but this mode of turning the machinery being found too expensive, they built another mill on a much larger scale at Cromford, in Derbyshire, which was turned by a water wheel, and from this circumstance the spinning machine was called the *water-frame*.

The difficulty, delay, and expense which attended the completing of the invention, prove, at the very least, that Arkwright did not receive it from any other person a *perfect* machine. If he had seen either Wyatt's machine, or the model of that of Highs, he had still to perfect the details; and the determined assiduity and confidence with which he devoted himself to this under-

* This was certainly an untrue description, and Mr. Guest remarks upon it, that Arkwright "did not scruple to masquerade in the character and trade of John Kay."—Reply, p. 58.

taking, before the machine had ever been made to answer, show that he had sufficient mechanical capacity to appreciate its value, and sufficient talent and energy to make the invention practicable and profitable.

Having completed the history of the great invention of spinning by rollers, it will be proper, before proceeding to describe the further progress of Arkwright in combining and improving the cotton machinery, to go back in the order of time, and to mention another invention for the purpose of spinning, which came into use before the water-frame, and which, though very different in its principle, almost rivalled that machine in utility. The great demand for yarn, while the one-thread wheel was the only instrument for spinning, set other wits on contriving a substitute for it, besides those of Wyatt, Highs, and Arkwright.

We learn from the "Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce," that in 1783 the society had in its repositories models of the following spinning machines: "A Spinning Wheel, by Mr. John Webb, invented 1761. A Spinning Wheel, by Mr. Thomas Perrin, 1761. A Horizontal Spinning Wheel, by Mr. Wm. Harrison, 1764. A Spinning Wheel, by Mr. Perrin, 1765. A Spinning Wheel, by Mr. Garrat, 1766. A Spinning Wheel, by Mr. Garrat, 1767."* Between the establishment of the society in 1754 and the year 1783, it distributed £544. 12s. in premiums "for improving several machines used in manufactures, viz. the comb-pot, cards for wool and cotton, stocking frame, loom, machines for winding and doubling, and spinning wheels."† None

* Transactions of the Society of Arts, vol. i. pp. 314, 315.
† Ibid. vol. i. p. 26.

of these inventions of spinning machines, however, succeeded. The compiler of the Transactions, writing in 1783, says, "From the best information hitherto obtained, it appears, that about the year 1764, a poor man, of the name of Hargreaves, employed in the cotton manufactory near Blackburn, in Lancashire, first made a machine in that county, which spun eleven threads; and that in the year 1770 he obtained a patent for the invention. The construction of this kind of machine, called a *Spinning Jenny*, has since been much improved, and is now at so high a degree of perfection, that one woman is thereby enabled with ease to spin a hundred threads of cotton at a time."*

James Hargreaves, a weaver of Stand-hill, near Blackburn, was the author of the admirable invention noticed in this extract.† It has been generally supposed that the date of the invention was 1767, not 1764; and Arkwright, in his "Case," states the machine to have been made in 1767. It is, however, in the highest degree probable, that the jenny would not be at once

* Ibid. vol. i. pp. 33, 34.

† Mr. Guest prefers a claim on the part of Thomas Highs, of Leigh, to the invention of the spinning-jenny, as well as of the water-frame. After attentively considering the evidence adduced, I am of opinion that it is quite insufficient to establish the claim. At the trial on Arkwright's patent, when Highs was examined pretty largely as to his inventions, he did not even allude to the jenny, which it is almost certain he would, to prove his great inventive talent, had he been the inventor. It is true that two men, named Thomas Leather and Thomas Wilkinson, the one 69 and the other 75 years old when their evidence was taken, stated in 1823 and 1827, that they knew Highs, and that he made a spinning-jenny about the year 1763 or 1764. The former also stated, that the machine was called *jenny* after Highs's daughter Jane; and there is ample evidence that Highs had a daughter of that name. It is added, that Kay, the clockmaker, assisted in the construction of this machine, as well as in that of the water-frame. The last-mentioned circumstance leads me to the belief that the witnesses have confounded the two inventions. Moreover, as Highs undoubtedly made jennies at a later period, and also invented a double jenny with some new apparatus, this fact

perfected: its construction would probably occupy the author, who was a poor man, and had to work for his daily bread, some years: and as Hargreaves went to Nottingham in 1768, before which time his machine had not only been perfected, but its extraordinary powers so clearly proved, notwithstanding his efforts to keep it secret, as to expose him to persecution and the attacks of a mob, I am strongly disposed to think that the invention was conceived, and that the author began to embody it, as early as 1764.

Hargreaves,* though illiterate and humble, must be regarded as one of the greatest inventors and improvers in the cotton manufacture. His principal invention, and one which shewed high mechanical genius, was the jenny. The date of this invention was some years before Arkwright obtained the patent for his water-frame; and it differs so completely from that machine, and from Wyatt's, that there can be no suspicion of its being other than a perfectly original invention.

It may be necessary to explain to some readers, that the cotton was formerly, and is still, reduced from the state of the fleecy roll called a carding, into the state of spun thread, by repeated, though similar operations:

may have given rise to the belief that he was the original inventor. The recollections of two aged men, concerning precise dates, after the lapse of sixty years, and concerning the precise form of a machine seen by them in mere boyhood, are little to be relied upon, especially for the purpose of overturning the claims of a most ingenious man, the patentee of the invention, and whose pretensions were never disputed till the appearance of Mr. Guest's book. Highs, however, has a third claim as an inventor; he stated, on Arkwright's patent trial, that he made a *perpetual carding* in the year 1773, which was before any other person did the same thing. It is certain that he was an extremely ingenious man, and he continued to make spinning machines till he was disabled by a stroke of the palsy, about the year 1790. He was supported in his old age by the liberality of Peter Drinkwater, Esq., of Manchester, and others, and died on the 13th December 1803, aged eighty-four years.

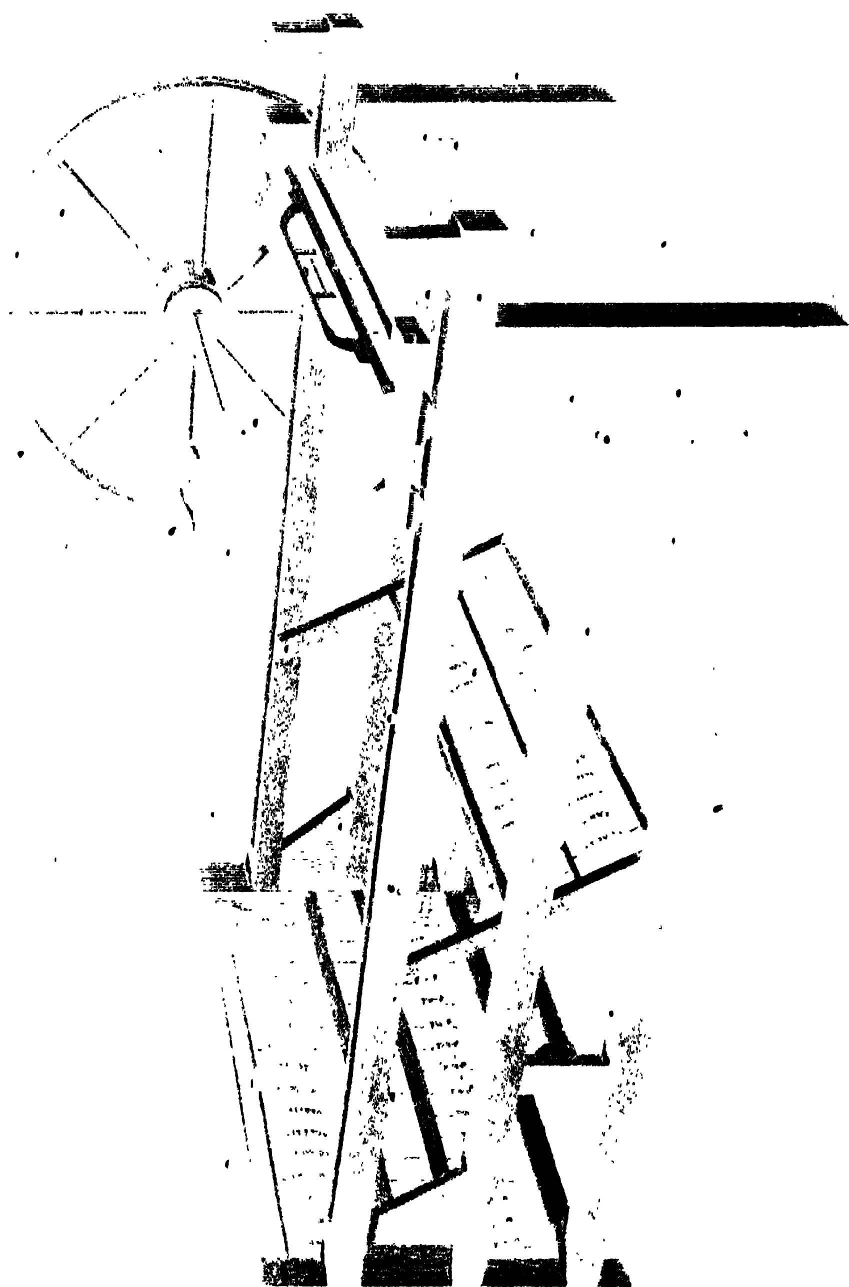
the first draws out the carding, and gives it a very slight twist, so as to make it into a loose thread, about the thickness of a candle-wick, in which state it is called a roving or slubbin; the subsequent processes draw out the roving much finer, and at length reduce it into yarn. Hargreaves's jenny, like Arkwright's machine, was intended to spin the roving into yarn; but it was not, like Arkwright's, capable of being applied to the preparation of the roving itself. Hargreaves is said to have received the original idea of his machine from seeing a one-thread wheel overturned upon the floor, when both the wheel and the spindle continued to revolve.* The spindle was thus thrown from a horizontal into an upright position; and the thought seems to have struck him, that if a number of spindles were placed upright, and side by side, several threads might be spun at once. He contrived a frame, in one part of which he placed eight rovings in a row, and in another part a row of eight spindles. The rovings, when extended to the spindles, passed between two horizontal bars of wood, forming a clasp, which opened and shut somewhat like a parallel ruler; when pressed together, this clasp held the threads fast. A certain portion of roving being extended from the spindles to the wooden clasp, the clasp was closed, and was then drawn along the horizontal frame to a considerable distance from the spindles, by which the threads were lengthened out, and reduced to the proper tenuity; this was done with the spinner's left hand, and his right hand at the same time turned a wheel, which caused the spindles to revolve rapidly, and thus the roving was spun into yarn.

* Rees's Cyclopædia, and Encyclopædia Britannica, art. "Cotton Manufacture."

By returning the clasp to its first situation, and letting down a presser wire, the yarn was wound upon the spindle. (See *Pl.* 4.)

With this admirable machine, though at first rudely constructed, Hargreaves and his family spun weft for his own weaving. Aware of the value of the invention, but not extending his ambition to a patent, he kept it as secret as possible for a time, and used it merely in his own business. A machine of such powers could not, however, be long concealed; but when it became the subject of rumour, instead of gaining for its author admiration and gratitude, the spinners raised an outcry that it would throw multitudes out of employment, and a mob broke into Hargreaves's house, and destroyed his jenny. So great was the persecution he suffered, and the danger in which he was placed, that this victim of popular ignorance was compelled to flee his native county, as the inventor of the fly-shuttle had been before him. Thus the neighbourhood where the machine was invented, lost the benefit of it, yet without preventing its general adoption;—the common and appropriate punishment of the ignorance and selfishness which oppose mechanical improvements.

Hargreaves retired to Nottingham in 1768, where he entered into partnership with Mr. Thomas James, a joiner, who raised sufficient money to enable them to erect a small mill. He took out a patent for the jenny in 1770, the year after Arkwright had obtained his patent at the same place. The patent was "for a method of making a wheel or engine of an entire new construction, and never before made use of, in order for spinning, drawing, and twisting of cotton, and to be managed by one person only, and that the wheel or



engine will spin, draw, and twist *sixteen* or more threads at one time, by a turn or motion of one hand, and a draw of the other." The following is the inventor's description of the process,—"One person, with his or her right hand turns the wheel, and with the left hand takes hold of the clasps, and therewith draws out the cotton from the slubbin box; and, being twisted by the turn of the wheel in the drawing out, then a piece of wood is lifted up by the toe, which lets down a presser wire, so as to press the threads so drawn out and twisted, in order to wind or put the same regularly upon bobbins which are placed on the spindles." The number of spindles in the jenny was at first eight; when the patent was obtained, it was sixteen; it soon came to be twenty or thirty; and no less than one hundred and twenty have since been used.

Before quitting Lancashire, Hargreaves had made a few jennies for sale;* and the importance of the invention being universally appreciated, the interests of the manufacturers and weavers brought it into general use, in spite of all opposition. A desperate effort was, however, made in 1779—probably in a period of temporary distress—to put down the machine. A mob rose, and scoured the country for several miles round Blackburn, demolishing the jennies, and with them all the carding engines, water-frames, and every machine turned by water or horses. It is said that the rioters spared the jennies which had only twenty spindles, as these were by this time admitted to be useful; but those with a greater number, being considered mischievous, were

* It is mentioned by Mr Kennedy, that Crompton, the inventor of the mule, "learnt to spin upon a jenny of Hargreaves's make," in 1769.

destroyed, or cut down to the prescribed dimensions. It may seem strange, that not merely the working classes, but even the middle and upper classes, entertained a great dread of machinery. Not perceiving the tendency of any invention which improved and cheapened the manufacture, to cause an extended demand for its products, and thereby to give employment to more hands than it superseded, those classes were alarmed lest the poor-rates should be burdened with workmen thrown idle. They therefore connived at, and even actually joined in, the opposition to machinery, and did all in their power to screen the rioters from punishment.* This devastating outrage left effects more permanent than have usually resulted from such commotions. Spinners, and other capitalists, were driven from the neighbourhood of Blackburn to Manchester and other places, and it was many years before cotton-spinning was resumed at Blackburn. Mr. Peel, the grandfather of the present Sir Robert Peel, a skilful and enterprising spinner and calico printer, having had his machinery at Altham thrown into the river, and been in personal danger from the fury of the mob, retired in disgust to Burton, in Staffordshire, where he built a cotton-mill on the banks of the Trent, and remained there some years. A large mill, built by Arkwright, at Birkacre, near Chorley, was destroyed by a mob in the presence of a powerful body of police and military, without any of the civil authorities requiring their interference to prevent the outrage.†

* An honourable exception to this folly was found in the conduct of Dorning Rasbotham, Esq., a magistrate near Bolton, who published a sensible address to the weavers and spinners, in which he endeavoured to convince them that it was for their interest to encourage inventions for abridging labour.

† Edinburgh Review, No. xci. p. 14.

The subsequent history of Hargreaves has been very erroneously represented. The following is Arkwright's notice of this ingenious man:—"About the year 1767, one Hargreaves, of Blackburn, in Lancashire, constructed an engine that would at once spin twenty or thirty threads of cotton into yarn for the fustian manufacture; but because it was likely to answer in some measure the end proposed, his engines were burnt and destroyed, and himself driven out of Lancashire: he afterwards removed to Nottingham, and obtained a patent for his engine; but he did not even there long continue in the peaceable possession of it. His patent right was invaded, and he found it necessary to commence a prosecution: an association was soon formed against him; and being unable to contend against the united power of a body of men, he was obliged to give up the unjust and unequal contest. His invention was cruelly wrested from him; and he died in obscurity and great distress."*

In addition to this, it was stated in the *Edinburgh Review*, No. 91, that Hargreaves died in the workhouse at Nottingham.

I find, from careful inquiry, that both Arkwright's statement and that of the *Edinburgh Review* are unfounded. Mr. John James, formerly a cotton spinner, (the son of Mr. James, who was the partner of Hargreaves,) and also a grandson of Hargreaves's, are still living at Nottingham; and a gentleman of that town, well known for his extensive knowledge of local history and antiquities, has, at my request, kindly obtained from them, and from other authentic sources, the following particulars, which may be fully relied upon:—James Hargreaves went to Nottingham in 1768, and

* Arkwright's "Case."

worked for a while in the employment of Mr. Shipley, for whom he made some jennies secretly in his house. He was induced, by the offers of Mr. Thomas James, to enter into partnership with him; and the latter raised sufficient money, on mortgage and loan, to build a small mill in Hockley, where they spun yarn for the hosiers with the jenny. The patent was obtained in 1770. Finding that several of the Lancashire manufacturers were using the jenny, Hargreaves gave notice of actions against them: the manufacturers met, and sent a delegate to Nottingham, who offered Hargreaves £3000 for permission to use the machine; but he at first demanded £7000, and at last stood out for £4000. The negociation being broken off, the actions proceeded; but before they came to trial, Hargreaves's attorney (Mr. Evans) was informed that his client, before leaving Lancashire, had sold some jennies to obtain clothing for his children, (of whom he had six or seven;) and in consequence of this, which was true, the attorney gave up the actions, in despair of obtaining a verdict. The spinning business was carried on by the partners with moderate success, till the death of Mr. Hargreaves, which took place at his own house near the mill, in April, 1778.* In his

* Mr. John James, who is now in his 83d year, and who has a very strong memory, said to the gentleman from whom I have received my information—"I knew Mr. Hargreaves very well: he was a stout, broad-set man, about five feet ten inches high, or rather more: he first worked in Nottingham with Mr. Shipley about 1768, and here my father first met with him. He was making jennies for Shipley, who then wished to go into the cotton spinning. My father prevailed on him to leave Shipley, and embark with him in a new concern; and money was borrowed by my father, principally on the mortgage of some freehold property, on which they were to erect their mill. The mill was erected, and two dwelling houses, in one of which my father resided, in the other was Mr. Hargreaves's family." Mr. John James himself paid Mrs. Hargreaves £400 from his father, on the death of her husband.

will he directed a guinea to be given to the vicar, for preaching his funeral sermon. His widow received £400 from Mr. James, for her husband's share in the business; and, having other property which her husband had accumulated, she left this sum to her children on her death.*

It will be a consolation to the admirers of genius, to find that this benefactor of his country was enabled to live in comfort, though not in affluence, on the fruits of his invention. It is not difficult to account for Arkwright's misstatement of the facts regarding Hargreaves: the statement was calculated to awaken a sympathy for inventors, and therefore it answered Arkwright's purpose. The mention made by him of the invention of Hargreaves fell far below its real merits; but this again answered the purpose of Arkwright, whose object was to set off his own transcendent and incomparable talents as an inventor.

The two important inventions for spinning, of which the history has been traced, broke down the barrier which had so long obstructed the advance of the cotton manufacture. The new machines not only turned off a much greater quantity of yarn than had before been produced, but the yarn was also of a superior quality. The water-frame spun a hard and firm thread, calculated for warps; and from this time the warps of linen yarn were abandoned, and goods were, for the first time

* In the register of burials belonging to St. Mary's parish, Nottingham, the entry stands as follows:—"1778, April 22, *James Hargraves*." The grandson of the inventor, however, states that the name was certainly spelt *Hargreaves*, and it was thus entered in the corporation books of Nottingham, when the inventor's son was made a burgess.

in this country, woven wholly of cotton. Manufactures of a finer and more delicate fabric were also introduced; especially calicoes, imitated from the Indian fabrics of that name. The jenny was peculiarly adapted for spinning weft; so that the two machines, instead of coming in conflict, were brought into use together. The spirit of invention and improvement, fully aroused by the proof which had now been given of the powers of mechanical combination, operated with extraordinary vigour; and amongst the numberless schemes and experiments tried in the workshops of Lancashire, not a few contrivances of real value were discovered, to perfect the various machines. This period of high intellectual excitement and successful effort would be contemplated with more pleasure, if there had not at the same time been displayed the workings of an insatiable cupidity and sordid jealousy, which remorselessly snatched from genius the fruit of its creations, and even proscribed the men to whom the manufacture was most deeply indebted. Ignorance on the one hand, and cupidity on the other, combined to rob inventors of their reward.

Arkwright, though the most successful of his class, had to encounter the animosity of his fellow-manufacturers in various forms. Those in Lancashire refused to buy his yarns, though superior to all others, and actually combined to discountenance a new branch of their own manufacture, because he was the first to introduce it. He has related the difficulties with which he had to contend in his "Case."

"It was not," he said, "till upwards of five years had elapsed after obtaining his first patent, and more

than £12,000 had been expended in machinery and buildings, that any profit accrued to himself and partners." "The most excellent yarn or twist was produced; notwithstanding which, the proprietors found great difficulty to introduce it into public use. A very heavy and valuable stock, in consequence of these difficulties, lay upon their hands: inconveniences and disadvantages of no small consideration followed. Whatever were the motives which induced the rejection of it, they were thereby necessarily driven to attempt, by their own strength and ability, the manufacture of the yarn. Their first trial was in weaving it into stockings, which succeeded; and soon established the manufacture of calicoes, which promises to be one of the first manufactures in this kingdom. Another still more formidable difficulty arose; the orders for goods which they had received, being considerable, were unexpectedly countermanded, the officers of excise refusing to let them pass at the usual duty of 3d. per yard, insisting on the additional duty of 3d. per yard, as being calicoes, though manufactured in England: besides, these calicoes, when printed, were prohibited. By this unforeseen obstruction, a very considerable and very valuable stock of calicoes accumulated. An application to the commissioners of excise was attended with no success; the proprietors, therefore, had no resource but to ask relief of the legislature; which, after much money expended, and *against a strong opposition of the manufacturers in Lancashire,* they obtained."*

This opposition of the Lancashire manufacturers to the establishment of a new branch of their own trade,

* "Case," in Arkwright's Patent Trial, p. 99.

seems to have been gratuitously malicious, and, fortunately for themselves, it was unsuccessful. With somewhat more of reason, the silk and woollen manufacturers had opposed the introduction of Indian calicoes at the end of the preceding century, finding that this new and elegant fabric came into competition with their own products. They then, as has been shown, so completely prevailed, as to obtain the entire prohibition of Indian, Persian, or Chinese silks and printed calicoes, for home consumption: and when calico printing extended in this country, and great quantities of calicoes manufactured in India, but printed or dyed in England, were used for apparel and household furniture, parliament again interfered in 1720, and passed an Act (7 Geo. I. c. 7,) prohibiting altogether "the *use* or *wear* in Great Britain, in any garment or apparel whatsoever, of ANY *printed, painted, stained, or dyed calico*, under the penalty of forfeiting to the informer the sum of £5." By the same Act, the use of printed or dyed calico "in or about any bed, chair, cushion, window curtain, or any other sort of household stuff or furniture," was forbidden under a penalty of £20; and the same penalty attached to the seller of the article. And so far did the Act extend, that it forbad the use of any printed or dyed goods, of which cotton formed any part; so that the goods made of linen warp and cotton weft could not be used in the printed or dyed state. Calicoes dyed all blue, as well as muslins, neckcloths, and fustians, were excepted from the prohibitions of this act. The prohibition to use mixed goods containing cotton, in the dyed or printed state, seems not to have been strictly enforced; and as it obviously struck at the existence of the then rising cotton manufacture of England, that

part of the Act of 1720 was repealed in 1736. The Act 9 Geo. II. c. 4, after reciting the 7th Geo. I. c. 7, set forth that, "Whereas great quantities of stuffs made of linen yarn and cotton wool have for several years past been manufactured, and have been printed and painted within this kingdom of Great Britain, and the said manufactures so printed or painted are a branch of the ancient fustian manufacture of this kingdom, and have been and now are used and worn in apparel and furniture: and whereas some doubts have lately arisen, whether the use and wearing of the said stuffs, when the same are so printed or painted, be prohibited by the said recited act, whereby the said manufacture is discouraged, and may be utterly lost, and great numbers of his majesty's subjects and their families, whose livelihoods entirely depend thereupon, may be ruined, and the poor greatly increased, if not timely prevented;" therefore it was enacted that it should be lawful to wear and use "any sort of stuff made of linen yarn and cotton wool manufactured and printed or painted, with any colour or colours within the kingdom of Great Britain, *provided that the warp thereof be entirely linen yarn.*" So that even this Act prohibited the use of printed goods made entirely of cotton; a prohibition directed against the printing of Indian calicoes, no such goods being then made in England.

These laws, though injurious to the public, were (for the time at least) beneficial to the home manufacturer; but the prohibition of English-made calicoes was so utterly without an object, that its being prayed for by the cotton manufacturers of this country is one of the most signal instances on record of the blinding effects of commercial jealousy. The legislature did not yield

to the despicable opposition offered to the reasonable demand of Mr. Arkwright and his partners, but, on the contrary, passed a law, in 1774, sanctioning the new manufacture, and rendering English calicoes subject only to a duty of 3d. per square yard on being printed.

This Act, the 14th George III. c. 72, is so important, as being the first legislative recognition of a British manufacture consisting wholly of cotton, that it will be proper to extract the preamble and the principal clauses:—

"*An Act for ascertaining the duty on printed, painted, stained, or dyed stuffs, wholly made of cotton, and manufactured in Great Britain, and for allowing the use and wear thereof, under certain regulations.*

"I. Whereas a new manufacture of stuffs, wholly made of raw cotton wool, (chiefly imported from the British plantations,) hath been lately set up within this kingdom, in which manufacture many hundreds of poor persons are employed: and whereas the use and wear of printed, painted, stained, or dyed stuffs, wholly made of Cotton, and manufactured in Great Britain, ought to be allowed under proper regulations: and whereas doubts have arisen whether the said new manufactured stuffs ought to be considered as Callicoes, and as such, if printed, painted, stained, or dyed with any colour or colours, (such as shall be dyed throughout of one colour only excepted) liable to the inland or excise duties laid on Callicoes when printed, painted, stained, or dyed with any colour or colours (except as aforesaid) by the statutes made and now in force, concerning the same; whether the wearing or use of the said new manufactured stuffs when the same are printed, painted, stained, or dyed, are not prohibited by an act passed in the seventh Year of the Reign of his late Majesty, King George the first, intituled, An Act to preserve and encourage the Woollen and Silk Manufactures of this Kingdom, and for more effectually employing the Poor, by prohibiting the use and wear of all printed, painted, stained, or dyed Callicoes in Apparel, Household Stuff,

Furniture or otherwise, after the twenty fifth day of December one thousand seven hundred and twenty two (except as therein is excepted): For obviating all such doubts for the future, may it please your most excellent Majesty that it may be enacted; and be it enacted by the king's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons in this present Parliament assembled, and by the authority of the same, that no greater or higher duty than three pence for every yard in length reckoning yard wide, and after that rate for a greater or lesser quantity, shall be imposed, raised, levied, collected, or paid unto and for the use of His Majesty, his heirs and successors, on the said new manufactured stuffs wholly made of cotton spun in Great Britain, when printed, stained, painted, or dyed with any colour or colours.

"II. And be it further enacted by the authority aforesaid, that it shall and may be lawful for any person or persons to use or wear, within the Kingdom of Great Britain, either as Apparel, Household Stuff, Furniture, or otherwise, any new manufactured stuffs wholly made of Cotton spun in Great Britain, when printed, stained, painted, or dyed with any colour or colours, any thing in the said recited Act of the seventh Year of the Reign of His late Majesty King George the first, or any other Act or Acts of Parliament to the contrary hereof in any wise notwithstanding.

"III. And to the end it may be known that such Stuffs were manufactured in Great Britain, be it further enacted, That in each piece of the said new manufactured stuffs, wholly made of Cotton Wool spun in Great Britain, there shall be wove in the warp in both selvages through the whole length thereof three blue Stripes, each Stripe of one thread only; the first of which said Stripes shall be the first or outermost thread of the warp of each selvage; the second of which said Stripes shall be the third thread; and the third of which said Stripes shall be the fifth thread of the warp from each selvage; and that each piece of the same stuffs, when printed, stained, painted, or dyed in England, Wales, or Berwick upon Tweed, be stamped at each end with a Stamp, to be provided for that purpose, by the Commissioners of Excise in England for the time being, or by the Officers employed or to be employed under them; and instead of the Word Callico, which stands for foreign Callicoes, each piece may be marked with the words *British*

Manufactory; and that each piece of the same stuffs, when printed, stained, painted, or dyed in Scotland, be stamped at each end with a Stamp to be provided for that purpose by the Commissioners of Excise in Scotland for the time being, or by the Officers employed or to be employed under them; and instead of the Word Callico, which stands for foreign Callicoes, each piece be marked with the Words *British Manufactory*."

The Act further provided, that persons exposing such stuffs to sale without the mark (unless for exportation) should forfeit the stuffs, and £50 for every piece; and persons importing such stuffs should be liable to lose the goods, and to forfeit £10 for each piece. The penalty of death was attached to the counterfeiting of the stamp, or the selling of the goods knowing them to have counterfeited stamps. Cotton velvets, velverets, and fustians were not affected by this Act.

The cotton manufacture, for some years after the great impulse was given to it, continued to move with comparative slowness. The power was applied, but it required time to overcome the *vis inertiæ* of society. Five years were requisite before Arkwright himself began to receive a profit. It needed other examples of success, to attract capital in a full stream to this employment. In the five years ending with 1775, the average import of cotton wool into Great Britain did not exceed 4,764,589 lbs. a year; only four times as much as the average import at the beginning of the century.

The machinery was still, however, very imperfect, especially in the preparation of the cotton for the spinning-frame. But in this, as in other departments, the manufacturers were on the alert for improvement. The important process of *carding* was about this time brought

to perfection. On this subject we must go back a little in our history.

Carding is the process to which the cotton is subjected after it has been opened and cleaned, in order that the fibres of the wool may be disentangled, straightened, and laid parallel with each other, so as to admit of being spun. This was formerly effected by instruments called hand-cards, which were brushes made of short pieces of wire, instead of bristles; the wires being stuck into a sheet of leather, at a certain angle, and the leather fastened on a flat piece of wood, about twelve inches long and five wide, with a handle. The cotton being spread upon one of the cards, it was repeatedly combed with another till all the fibres were laid straight, when it was stripped off the card in a fleecy roll ready for the rover. The first improvement was in making one of the two cards a fixture, and increasing its size; so that a workman, having spread the cotton upon it, might use a card double the size of the old cards, and do twice the quantity of work. The process was further facilitated by suspending the moveable card by a pulley from the ceiling, with a weight to balance it, so that the workman had only to move the card, without sustaining its weight. The stock-cards, as they were called, had been previously used in the woollen manufacture: at what period they were introduced into the cotton manufacture, I have not satisfactorily ascertained. It has been said that James Hargreaves, the inventor of the jenny, first applied them, with some improvement of his own, to the carding of cotton; but it will be seen by the letter of Mr. Charles Wyatt, (p. 135,) that John Wyatt, the inventor of spinning by rollers, spoke of cotton being carded with stock-cards in 1739.

The application of rotatory motion was the grand improvement in carding; and this improvement, singular as it may seem, is traced back to Lewis Paul, the patentee of spinning by rollers.

The carding patent of Lewis Paul,* of the 30th August, 1748, a copy of which, with the drawings, I have obtained from the Patent Office, includes two different machines for accomplishing the same purpose; the one a flat, and the other a cylindrical arrangement of cards. The following description in the specification applies equally to both:—"The said machine for carding of wool and cotton, &c. does consist and is to be performed in the manner following, to wit: The card is made up of a number of parallel cards, with intervening spaces between each, and the matter being carded thereon, is afterwards took off each card separately, and the several rows or filliments of wool or cotton so took off, are connected into one entire roll." The first machine described in the specification consists of a flat board, varying in dimensions from three feet by two, to two feet by fourteen inches, on which were nailed sixteen long cards, parallel to each other, with small spaces betwixt each. The wool or cotton being spread on the cards, a hand-card, of the same length as those nailed on the board, but only a quarter of the breadth, and completely covered with points of wire, was drawn over the lower cards till the operation was completed.

* In this patent, he thus describes himself,—"I, Lewis Paul, of Birmingham, gentleman;" from which it would appear that he was still living at Birmingham. Whether he yet carried on spinning in that town, or whether, as Mr. Kennedy supposes, he was connected with the concern at Northampton, I cannot learn. This remarkable man, of whom so little is known except the surprising inventions for which he obtained patents, lived at Birmingham in 1738 and 1748, and at Kensington, near London, in 1758.

The second and more important machine was a horizontal cylinder, covered in its whole circumference with parallel rows of cards, with intervening spaces, and turned by a handle. The specification drawing is represented in *Plate* 3, *fig.* 1; at p. 152. Under the cylinder was a concave frame, lined internally with cards, exactly fitting the lower half of the cylinder; so that, when the handle was turned, the cards of the cylinder and of the concave frame worked against each other, and carded the wool. This bears the closest resemblance to the modern carding cylinder, except that the concave frame is now placed *over* the cylinder, and in Paul's machine it was placed *under*. There was a contrivance for letting the concave part down by a lever and pulley, and turning it round, so as easily to strip off the carded wool.

When the wool was properly carded, it was stripped off, "by means of a stick, with needles in it, parallel to one another, like the teeth of a comb." The cardings were of course only of the length of the cylinder, but an ingenious apparatus was attached for making them into a perpetual carding. Each length was placed on a flat broad riband, which was extended between two short cylinders, and which wound upon one cylinder as it unwound from the other. When the carding was placed on the riband, the turning of one of the cylinders wound the riband and carding upon it; and, length being joined to length, the carding was made perpetual, and wound up in a roll, ready for the spinning machine. It has already been seen that the upper roller in Paul's patent spinning machine of 1758 was called the "riband cylinder."

Here, then, are the carding cylinder, the perpetual

carding, and the comb for stripping off the carding. It must be admitted, that the invention was admirable and beautiful, though not perfect. Its defects were,—that the cylinder had no feeder, the wool being put on by the hand;—that the cardings were taken off separately by a moveable comb, which of course required the machine to stop,—and that the perpetual carding was produced by joining short lengths with the hand, whereas now it is brought off the machine in a continuous roll, by a comb attached to the cylinder, and constantly worked against it by a crank. Paul's machine, though so great an improvement on the old method, was not known in Lancashire for twelve years, nor generally adopted for more than twenty years, after the date of the patent.

Thus the two most important and admirable inventions in cotton spinning, the carding by cylinders and spinning by rollers—which have also been adopted (with some modifications) in the manufactures of wool, worsted, flax, and tow—originated in the very same establishment, from twenty to thirty years earlier than is commonly supposed, and not in Lancashire, but in Warwickshire. As Paul's patent was obtained some years after Wyatt had retired from the concern, the invention was probably his own. These two extraordinary men were doubly unfortunate,—first, in their failure to realize profit by their splendid inventions, and, secondly, in losing the fame as well as the profit they deserved; for their merits have, until now, been recorded by no writer, and their names are merely handed down as the luckless contrivers of some unknown machinery. It may be hoped that, from the

proofs now published of their inventions, they will even yet receive the well-earned, though tardy, tribute of admiration from posterity.

When the establishment at Northampton, in which the carding cylinder is said to have been used, was broken up, that machine was bought by a Mr. Morris, and taken first to Leominster, in Hertfordshire, and afterwards to Brock mill, near Wigan, in Lancashire. Mr. Kennedy, in his "Brief Memoir of Samuel Crompton," says—"Lewis Paul was also in 1748 the patentee of the invention of revolving cylinders for carding cotton. This machine is the original of the machine for carding now used. After the breaking up of Wyatt and Paul's establishment at Northampton, it was purchased by a hat manufacturer from Leominster, and by him applied to the carding of wool for hats; and about 1760 it was introduced into Lancashire, and re-applied to the carding of cotton, by a gentleman of the name of Morris, in the neighbourhood of Wigan.*

The carding machine having thus been introduced into Lancashire, Mr. Peel was one of the first to adopt it, and he is said to have erected a machine with cylinders, by the aid of James Hargreaves, at Blackburn. His machine is stated to have consisted of two or three cylinders, covered with cards, the working of which in contact effectually carded the cotton;† but there were defects both in the means of putting the cotton upon the cylinders and of taking it off: the latter operation was performed by women with hand-cards. For some years, Mr. Peel laid aside this machine, and it only came into

* Memoirs of the Literary and Philosophical Society of Manchester, vol. v. of the second series, p. 326.

† Rees's Cyclopædia, art. "Cotton Manufacture."

general use after further improvements had been made in it, and about the same time that the spinning machines were adopted.

One of the first improvements made in the carding machine was the fixing of a perpetual revolving cloth, called a feeder, on which a given weight of cotton wool was spread, and by which it was conveyed to the cylinder. This was invented in 1772, by John Lees, a quaker, of Manchester.* Arkwright made a further improvement in this part of the machine, by rolling up the feeder with the cotton spread upon it, in a thick roll, which gradually unrols as the cylinder is fed. Another improvement had the effect of bringing off the carded wool from the cylinder in a continuous fleece, and forming it into a uniform and perpetual sliver. After the wool had been carded on the large cylinder, it was stripped off by a smaller cylinder, also covered with cards, revolving in contact with the larger, but in an opposite direction. The smaller was called the finishing cylinder or the doffer, and the cards were at first fixed upon it longitudinally, and with intervals between them; which did not produce a continuous fleece, but turned off the wool in rolls the length of the cylinder.

A Mr. Wood, and his partner, Mr. Pilkington, improved the process by entirely covering the finishing cylinder with narrow fillet cards, wound round it in a circular and spiral form, and without any intervals; the effect of which was to bring off the wool in an unbroken fleece. This they did before Arkwright took out his carding patent, in 1775, which included the

* See the evidence of John Lees, Thomas Hall, and Henry Marsland, on the trial concerning Arkwright's patent, in 1785.

very same contrivance: it is difficult to judge from the evidence, whether he or they first invented it, but they appear to have used it a year before the date of his patent, namely, in 1774.*

The manner in which the wool was stripped off the finishing cylinder, in Paul's machine, was by "needle-sticks," and, in Mr. Peel's machine, by hand-cards: afterwards a roller was employed, with tin plates upon it, like the floats of a water-wheel, which, revolving with a quick motion against the cylinder, scraped off the cotton from the card. This contrivance, however, injured both the cotton and the card.

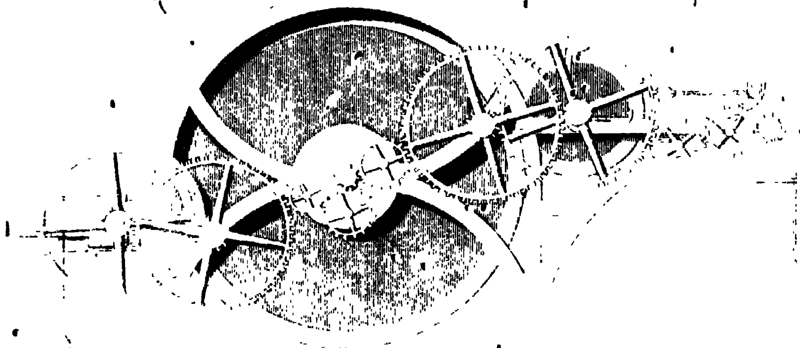
About the year 1773, a very ingenious contrivance was invented,—a plate of metal, finely toothed at the edge like a comb, which, being worked by a crank in a perpendicular direction, with slight but frequent strokes on the teeth of the card, stripped off the cotton in a continuous filmy fleece. The fleece as it came off was contracted and drawn through a funnel at a little distance in front of the cylinder, and was thus reduced into a roll or sliver, which, after passing betwixt two rollers, and being compressed into a firm flat riband, fell into a deep can, where it coiled up in a continuous length, till the can was filled.

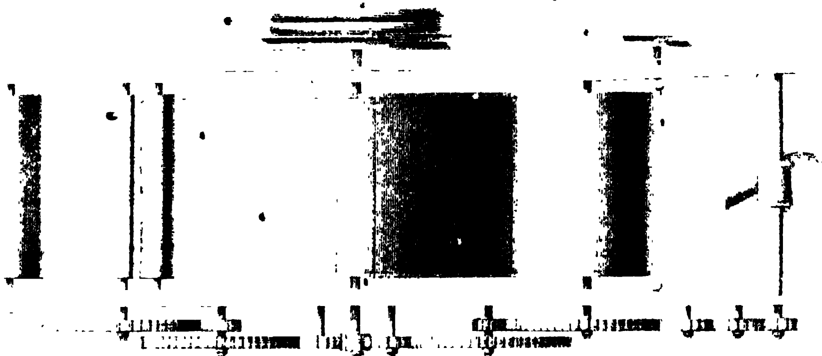
The crank and comb were claimed by Arkwright as one of his inventions, and were included in his carding patent. There has, however, been some doubt thrown on the authorship of this happy contrivance. At the trial several witnesses appeared, who ascribed the invention to James Hargreaves, the inventor of the jenny. Elizabeth and George Hargreaves, his widow

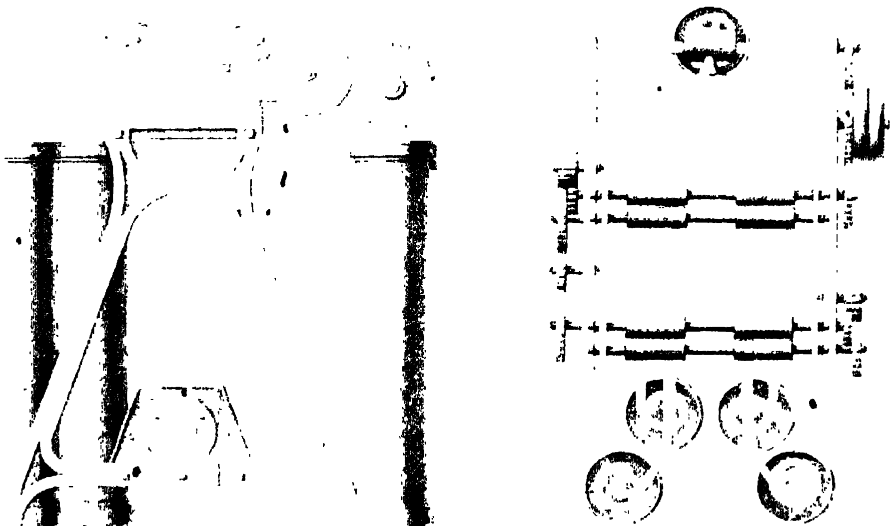
* See the evidence of Mr. Pilkington and Mr. Wood; that of the latter has the more weight, as he appeared as a witness *for* Arkwright on another part of the case.

and son, declared that he contrived the crank and comb two years before Arkwright took out his patent: the smith who made the apparatus for Hargreaves, confirmed this testimony: and several cotton spinners swore to their having used the crank and comb some time before the patent was taken out.* On the ground of all this evidence, and in the absence of any disproof of it by Arkwright, I had come to the conclusion that Hargreaves was the inventor. But just before these sheets go to the press, I have received the following distinct and important testimony in Arkwright's favour from the son of Mr. James, the partner of Hargreaves. He states as follows to the gentleman whom I have before referred to, as having procured me valuable information from Nottingham:—"He (James Hargreaves) was not the inventor of the crank and comb. We had a pattern chalked out upon a table by one of the Lancashire men in the employ of Mr. Arkwright; and I went to a frame-smith of the name of Young to have one made. Of this Mr. Arkwright was continually complaining, and it occasioned some angry feelings between the parties." This single testimony, coming from a gentleman of unquestionable veracity, who had personal knowledge of and share in the transaction, and whose bias would naturally be more favourable to Hargreaves than to Arkwright, seems to me to outweigh all the others. It is also to be remembered that Arkwright, on applying for a new trial, offered evidence to disprove that of Elizabeth and George Hargreaves. It is quite possible that these witnesses believed their relative to be the

* See the evidence of Elizabeth and George Hargreaves, George Whitaker, Richard Hudson, John Bird, Thomas Chatterton, and Thomas Ragg, on the trial.







inventor of the crank and comb; the smith, too, may have made it from Hargreaves's directions; and the other cotton spinners, may have used it before Arkwright took out his patent: and still Arkwright may have been the inventor, and his workmen may have communicated it to others, as one of them evidently did to Hargreaves and his partner.

Mr. Wood used a fluted roller armed with needles, to doff the cotton; and both this contrivance and the metallic comb seem to have had their prototype in the "needle-sticks" of Lewis Paul; but experience has decided in favour of the crank and comb as the best apparatus.

By these several inventions and improvements the carding engine was perfected. It became a most important, as well as beautiful machine. At one end of it the cotton-wool was put in, an entangled and knotted mass, the fibres lying in every direction; and at the other end the wool came out an even, delicate film, with the fibres straightened, and that film immediately compressed into a uniform and continuous sliver, ready for the spinner. Most of these improvements are to be ascribed to Arkwright, and he shewed his usual talent and judgment in combination, by putting all the improvements together, and producing a complete machine, so admirably calculated for the purpose, that it has not been improved upon to the present day.

Plate 5, figures 1 and 2, shew the carding machine; and the operation of carding is well seen in the engraving after Mr. Allom's sketch, of the carding, drawing, and roving room, in the large mill of Messrs. Swainson, Birley, and Co. near Preston. (*Pl.* 6.)

When Arkwright took out his patent for the carding

machine, he also included in it machines for *drawing* and *roving*.

Drawing is a process to which the cotton is subjected after it leaves the carding engine, and before it is taken to the roving frame. It consists in *drawing out* the carding by rollers, and then *doubling* and *redoubling* the slivers, which are called *ends*, so as to restore them to nearly the same substance as at first. This process is several times repeated. The objects in thus repeatedly drawing out the cotton are two-fold :—

1st. More perfectly to *straighten and lay at their full length* all the fibres of the cotton, than it is possible for the carding engine to do : the teeth of the cards often lay hold of a fibre by the middle, in which case it is doubled, and is unfit for being spun ; the drawing process, by the continual pulling forward of the whole mass, loosely, and so as to let the fibres stretch out each other, extends them at their full length, and prepares them for being twisted into a fine and even thread.

The 2d object of the process is, to *equalize* the *thickness* of the cardings. One carding may have more or less substance than another, though the variations cannot be very great, as a given weight of wool is always spread upon a given surface of the feeder of the carding engine ; the drawing and doubling averages the irregularities, and thus reduces the cardings as nearly as possible to a uniform substance or grist. For example, four cans, each filled with an end of carding, are placed behind the frame ; and the ends are passed through two pairs of rollers, which draw them out to four times their former length and fineness. They are thus reduced to one-fourth of their original substance ; but, on being *united* by being passed together through a funnel in

front of the rollers, the four become of the same substance as each end was of at first.

The united sliver falls into a can, and of course four cans will be successively filled, before the four cans at the back of the machine are emptied. Thus the same length and substance of sliver is produced as at first, and deposited in as many cans. The only difference is, that the fibres have been straightened, and the irregularities of the first four cardings have been averaged and equalized, by the process. Each can now contains a portion of all the four original cardings. Repeat the process; the fibres are still further straightened, and the irregularities are still further reduced. Each sliver now contains portions of *sixteen* slivers. If repeated again, each sliver will contain portions of *sixty-four* slivers. And every time the drawing and doubling is repeated, the irregularities in the substance or grist of the sliver will be reduced. The number of times that the cardings are passed through the drawing frame depends partly on the quality of the cotton, and partly on the kind of yarn required: cotton which is long and strong in the staple or fibre, needs to be doubled oftener than than that which is short and weak; and the harder and finer the yarn to be spun, the more frequently should this operation be performed. It is common for the slivers to be passed through the drawing frame till each contains portions of several thousand slivers. The operation of drawing will be seen from *Plate* 5, *figs.* 3 and 4.

The *roving frame* performs the first process of spinning, by making the sliver into a thick loose thread. This is done by a machine on the same principle as the spinning frame. The carding is drawn out of the can

into which it was delivered from the drawing frame; it passes through three pairs of rollers, which by their different velocities stretch it out; and it is then slightly twisted, and wound on the bobbins. Arkwright, however, did not wind the thread on bobbins, but allowed it to fall into an upright can, revolving rapidly on its axis; the revolution of the can gave the roving its twist, no spindle being used: when the can was filled, the roving was wound upon bobbins at the winding frame. He claimed the can as his own invention, but it was proved on the trial to have been in use long before he obtained his patent. This machine, called the roving or slubbing frame, is seen in the plate representing the carding, drawing, and roving room. (*Pl.* 6.)

It will be seen that the drawing and roving frames depend on exactly the same principles as the spinning frame, for which Arkwright took out his patent in 1769; they are mere modifications of that machine: but the new processes which they were made to perform were indispensable to the perfecting of the yarn. He was the first to introduce the drawing process, and to apply the spinning rollers to the purpose of roving; and very great merit belongs to him on that account.

On the 16th December, 1775, Mr. Arkwright took out a second patent, for a series of machines, comprising the carding, drawing, and roving machines, all used "in preparing silk, cotton, flax, and wool for spinning." The said machines were said to be "constructed on easy and simple principles, very different from any that had ever yet been contrived;" and Arkwright claimed to be "the first and sole inventor thereof," and asserted that "the same had never been practised by any other person or persons whomsoever, to the best of his know-

ledge and belief." That this statement is to be received with some allowance, the reader will perceive from the history we have given of the inventions.

When this admirable series of machines was made known, and by their means yarns were produced far superior in quality to any before spun in England, as well as lower in price, a mighty impulse was communicated to the cotton manufacture. Weavers could now obtain an unlimited quantity of yarn, at a reasonable price; manufacturers could use warps of cotton, which were much cheaper than the linen warps formerly used. Cotton fabrics could be sold lower than had ever before been known. The demand for them consequently increased. The shuttle flew with fresh energy, and the weavers earned immoderately high wages. Spinning mills were erected to supply the requisite quantity of yarn. The fame of Arkwright resounded through the land; and capitalists flocked to him, to buy his patent machines, or permission to use them. He "sold to numbers of adventurers, residing in the different counties of Derby, Leicester, Nottingham, Worcester, Stafford, York, Hertford, and Lancaster, many of his patent machines. Upon a moderate computation, the money expended in consequence of such grants (before 1782) amounted to at least £60,000. Mr. Arkwright and his partners also expended, in large buildings in Derbyshire and elsewhere, upwards of £30,000, and Mr. Arkwright also erected a very large and extensive building in Manchester, at the expense of upwards of £4000." Thus "a business was formed, which already (he calculated) employed upwards of five thousand persons, and a capital on the whole of not less than £200,000."*

* Arkwright's "Case."

On the trial concerning the validity of the patent, in 1785, only three years later, Mr. Bearcroft, the counsel opposed to Mr. Arkwright, stated, that thirty thousand people were employed in the establishments set up *in defiance of the patent*, and that near £300,000 had been expended in the buildings and machinery of those establishments. If we add to this the mills where the patent machines were used, the capital and the population employed will much exceed these amounts.

The factory system in England takes its rise from this period. Hitherto the cotton manufacture had been carried on almost entirely in the houses of the workmen: the hand or stock cards, the spinning wheel, and the loom, required no larger apartment than that of a cottage. A spinning jenny of small size might also be used in a cottage, and in many instances was so used: when the number of spindles was considerably increased, adjacent work-shops were used. But the water-frame, the carding engine, and the other machines which Arkwright brought out in a finished state, required both more space than could be found in a cottage, and more power than could be applied by the human arm. Their weight also rendered it necessary to place them in strongly-built mills, and they could not be advantageously turned by any power then known but that of water.

The use of machinery was accompanied by a greater division of labour than existed in the primitive state of the manufacture; the material went through many more processes; and of course the loss of time and the risk of waste would have been much increased, if its removal from house to house at every stage of the manufacture had been necessary. It became obvious that there were several important advantages in carrying on the numerous operations of an extensive manufacture in the



same building. Where water power was required, it was economy to build one mill, and put up one water-wheel, rather than several. This arrangement also enabled the master spinner himself to superintend every stage of the manufacture: it gave him a greater security against the wasteful or fraudulent consumption of the material: it saved time in the transference of the work from hand to hand:—and it prevented the extreme inconvenience which would have resulted from the failure of one class of workmen to perform their part, when several other classes of workmen were dependent upon them. Another circumstance which made it advantageous to have a large number of machines in one manufactory was, that mechanics must be employed on the spot, to construct and repair the machinery, and that their time could not be fully occupied with only a few machines.

All these considerations drove the cotton spinners to that important change in the economy of English manufactures, the introduction of the factory system; and when that system had once been adopted, such were its pecuniary advantages, that mercantile competition would have rendered it impossible, even had it been desirable, to abandon it. The inquiry into the moral and social effects of the factory system will be made hereafter. At present we observe, that although Arkwright, by his series of machines, was the means of giving the most wonderful extension to the system, yet he did not absolutely originate it. Mills for the throwing of silk had existed in England, though not in any great number, from the time of Sir Thomas Lombe, who, in 1719, erected a mill on the river Derwent, at Derby, on the model of those he had seen in Italy.

It has been seen that Wyatt's first machines, at

Birmingham, were turned by asses, and his establishment at Northampton by water. So Arkwright's first mill, at Nottingham, was moved by horses; his second, at Cromford, by water. "During a period of ten or fifteen years after Mr. Arkwright's first mill was built (in 1771) at Cromford, all the principal works were erected on the falls of considerable rivers; no other power than water having then been found practically useful. There were a few exceptions, where Newcomen's and Savery's steam-engines were tried. But the principles of these machines being defective, and their construction bad, the expense in fuel was great, and the loss occasioned by frequent stoppages was ruinous."*

Cotton spinning, the history of which is almost romantic, has been made poetical by Dr. Darwin's powers of description and embellishment. In his "*Botanic Garden*" he thus sings the wonders of Arkwright's establishment on the Derwent, at Cromford:—

——— "Where Derwent guides his dusky floods
Through vaulted mountains and a night of woods,
The nymph *Gossypia* treads the velvet sod,
And warms with rosy smiles the wat'ry god;
His pond'rous oars to slender spindles turns,
And pours o'er massy wheels his foaming urns;
With playful charms her hoary lover wins,
And wields his trident while the Monarch spins.
First, with nice eye, emerging Naiads cull
From leathery pods the vegetable wool;
With wiry teeth *revolving cards* release
The tangled knots, and smooth the ravell'd fleece
Next moves the *iron hand* with fingers fine,
Combs the wide card, and forms th' eternal line;

* Mr. Kennedy "On the Rise and Progress of the Cotton Trade;" Memoirs of the Manchester Literary and Philosophical Society, Vol. III. 2d series, p. 126.

Slow with soft lips the *whirling can* acquires
The tender skeins, and wraps in rising spires:
With quicken'd pace *successive rollers* move,
And these retain, and those extend, the *rove*
Then fly the spokes, the rapid axles glow,
While slowly circumvolves the labouring wheel below."

Arkwright was now rapidly making a large fortune, not merely by the sale of his patent machines and of licences to use them, but much more by the profits of his several manufactories; for, having no less enterprise than judgment and skill, and being supported by large capital and very able partners, he greatly extended his concerns, and managed them all with such ability as to make them eminently prosperous. He offered the use of his patents by public advertisements, and gave many permission to use them on receiving a certain sum for each spindle. In several cases he took shares in the mills erected; and from these various sources he received a large annual tribute.

His success stimulated the jealousy of his fellow-manufacturers; and as there was a prevalent belief in Lancashire that Arkwright was not really the author of the inventions for which he had obtained patents, several persons ventured to set up machines similar to his, without obtaining his licence. To vindicate his claim, and to secure the profits of his patent, he instituted nine actions in the year 1781; only one of which, that against Colonel Mordaunt, came to trial. An association of Lancashire spinners was formed, to defend the actions; and Mr. Charles Taylor, of Manchester, afterwards secretary to the Society for the Encouragement of Arts, Manufactures, and Commerce, in the Adelphi, had the principal share in arranging the evidence, and exposing the defects of the patent. The action was for the

infringement of the second patent, namely, that for the carding, drawing, and roving machines. The counsel for Colonel Mordaunt were Mr. Bearcroft, and Mr. (afterwards Lord) Erskine; and Arkwright had on his side a considerable number of the most eminent counsel of the day. The defence was confined to the single point, that the specification given in by Arkwright on obtaining his patent, was obscure and unintelligible. Every inventor, on taking out a patent, is required by law to give in a specification, "particularly describing and ascertaining the nature of his invention, and in what manner the same is to be performed;" for the purpose of enabling all other persons to make the machine at the expiration of the patent. Arkwright gave in a specification, with drawings; but there was much obscurity in the description,—some things which were absolutely essential being omitted, and others which were not used at all in the cotton manufacture introduced; and the drawings were so unintelligible, from the want of any scale, and from the several parts of the machines being drawn separately, without any general view of the entire machines, that it was manifest he had not intended to disclose his invention, but rather to conceal it.* Evidence was given on the trial, by the person who had been employed to draw the formal part of the specification, that Arkwright "told him, he meant it to appear to operate as a specification, but to be as obscure as the nature of the case could possibly admit."† On this evidence, and that of

* As specimens of this studied obscuration, it may be mentioned, that the very first article in his specification and drawing was a hammer, not of his own invention, and of no use in the cotton manufacture, but merely used to beat hemp; and that the wheels by which the whole machine was turned, were not introduced at all!

† See the evidence of Mr. W. D. Crofts; Trial, p. 75.

other witnesses, mechanics, who stated that they could not construct the machine from that specification, the jury, with the perfect concurrence of the judge, found a verdict for the defendant. Thus this celebrated and profitable patent was set aside.

Arkwright did not for a long time venture to dispute this verdict; but, conceiving that he had a claim to national reward for the great inventions which he had been the means of perfecting, he drew up a document, entitled, "The Case of Mr. Richard Arkwright and Co. in relation to Mr. Arkwright's invention of an engine for spinning cotton, &c. into yarn; stating his reasons for applying to Parliament for an Act to secure his right in such invention, or for such other relief as to the Legislature shall seem meet." He began by showing the importance of manufactures to the commerce and prosperity of Great Britain, and proceeded to argue the expediency of encouraging mechanical inventions, on which manufacturing success greatly depended. The difficulties and disappointments which inventors had to encounter, were illustrated by the cases of Paul and Hargreaves, in terms which have already been quoted. Arkwright's own merits as an inventor, his "intense study and labour," his "unparalleled diligence and application, the force of his natural genius, and his unbounded invention," were then insisted upon in terms as lofty and confident as if he had been the sole author of the inventions for which he had obtained patents. His successful efforts to establish the new system of spinning, and his introduction of the calico manufacture in spite of opposition and jealousy, were with truth exhibited to parliament as entitling him to the gratitude of the nation. He then represented that others had

"devised means to rob him of his inventions, and to profit by his ingenuity;" that "his servants and workmen (whom he had with great labour taught the business) were seduced;" that thus "a knowledge of his machinery and inventions was fully gained;" that "many persons began to pilfer something from him, and then, by adding something else of their own, and by calling similar productions and machines by other names, they hoped to screen themselves from punishment." To guard his own rights, he found it necessary to prosecute several; which "occasioned, as in the case of poor Hargreaves, an association against him of the very persons whom he had served and obliged." He then pathetically and plausibly described the legal proceedings and their issue; and he contended that "it could not be supposed that he meant a fraud on his country" by the obscurity of his specification. On the contrary, his object was to benefit his native country, by preventing the introduction of such important machines into other countries; "in prevention of which evil, he had purposely omitted to give so full and particular a description of his inventions, in his specification, as he otherwise would have done." "Indeed, it was impossible (he argued) that he could either expect or intend to secrete his inventions from the public after the expiration of his patents; the whole machinery being necessarily known to many workmen and artificers, as well as to those persons (being many hundreds) who were employed in the manufactory. This observation alone, independent of the circumstances of the grants which had been made, was fully sufficient to evince that Mr. Arkwright had no such view." Having thus exhibited his claims, and refuted the imputation of selfishness

and fraud to which the studied obscurity of the specification had exposed him,—and having also stated, to show the service he had rendered his country, that the cotton spinning business "already employed upwards of five thousand persons, and a capital, on the whole, of not less than £200,000,"—he concluded by praying "that the legislature would be pleased to confirm, connect, and consolidate the *two* letters patent, so as to preserve to him the full benefit of his inventions for the remainder of the term yet to come in the *last* patent, which favour would be received by him with the deepest sense of gratitude."

Whatever were the services Arkwright had rendered his country, he here asked for an enormous reward. His first patent, obtained in 1769, would expire in 1783, the year after this "Case" was drawn up; and the second patent, obtained in 1775, would not expire till the end of the year 1789. He was therefore asking for the patent right of all the machines to be continued to him for eight years longer, which alone would have secured him an immense fortune. It is probable that Arkwright found an indisposition on the part of ministers to favour his application; for he abandoned his intention of applying to parliament, though he had circulated his "Case" with that view.

At the beginning of 1785, Arkwright made another effort to establish his second patent, and brought an action for its infringement, which was tried in the court of Common Pleas on the 17th of February. Lord Loughborough, the chief justice, on that occasion expressed an opinion favourable to the sufficiency of the specification, and on this ground Arkwright obtained a verdict. Alarmed by this unexpected event, the cotton

spinners of Lancashire, who had formed an association to defend the actions in 1781, and several of whom had since erected machines on Arkwright's principle without his permission, applied for and obtained from the lord chancellor a writ of *scire facias*, to try the validity of the patent. This was tried in the Court of King's Bench, before Mr. Justice Buller and a special jury, on the 25th of June, 1785. The cause was most ably argued on both sides, and a great number of witnesses were called: models of the machines were placed on the table, and worked. Mr. Bearcroft, the counsel for the crown, opposed the validity of the patent on four grounds: 1st, that it was a great inconvenience to the public; 2d, that it was not a new invention at the time of the patent being granted; 3d, that it was not a new invention by Mr. Arkwright at all; and, 4th, that he had not disclosed his invention in the specification. All the witnesses were now examined, to whose evidence we have alluded, as proving that several of the improvements in the carding engine were invented by others before Arkwright took out his patent; and Highs and Kay were also examined, to prove that the former had invented the mode of spinning by rollers, and that it had been communicated by the latter to Arkwright. Several mechanics stated that they could not understand the specification. A very strong case was made out against the patent, and it was feebly met on the side of Arkwright. The result was, that the jury, without a minute's hesitation, brought in their verdict for the crown, which was a sentence of nullification of the patent.* On the 10th of November, in the same year,

* It appears from a placard issued in Manchester, announcing the result of the trial, that the verdict was not given till one o'clock in the morning, and that the

Arkwright applied for a new trial, alleging that he had evidence to contradict that of Highs, Kay, and the widow and son of Hargreaves; but the court refused the motion, and judge Buller observed, that he was convinced at the trial that "the defendant had not a leg to stand upon."

Thus Arkwright's patent was finally set aside; and those most useful machines, which, though invented by others, owed their perfection to his finishing hand, were thrown open to the public. The astonishing extension of the manufacture which immediately followed, shewed that the nullification of the patent was a great national advantage.

Arkwright continued, notwithstanding, his prosperous career. Wealth flowed in upon him with a full stream from his skilfully managed concerns. For several years he fixed the price of cotton twist, all other spinners conforming to his prices. His partnership with the Messrs. Strutt terminated about 1783, and he retained the works at Cromford, still carried on by his son; whilst Messrs. Strutt had the works at Belper, which also are yet conducted by the surviving members of their family. In 1786, Arkwright was appointed high sheriff of Derbyshire; and having presented an address of congratulation from that county to the king

defeat of Arkwright gave great satisfaction to the people of that town. The Lancashire spinners were, indeed, Arkwright's great enemies. Owing partly, perhaps, to his humble origin, and partly to the doubts whether he was the author of the inventions, "he had no honour in his own country." Being of an irritable temperament, he resented this treatment, and exerted himself to raise up a successful rivalry to Lancashire. He therefore favoured the Scotch spinners as much as possible, and formed a partnership with David Dale, Esq. of Lanark mills; in allusion to which, and probably by way of retorting the unworthy taunts of his opponents relative to his former occupation, he said, that "he would find a *razor* in Scotland to *shave* Manchester."

on his escape from the attempt of Margaret Nicholson on his life, Arkwright received the honour of knighthood. Sir Richard was for many years troubled with a severe asthmatic affection; he sunk at length under a complication of disorders, and died at his house at Cromford, on the 3d of August, 1792, in the sixtieth year of his age.

I have found myself compelled to form a lower estimate of the inventive talents of Arkwright than most previous writers. In the investigation I have prosecuted, I have been guided solely by a desire to ascertain the exact truth. It has been shewn that the splendid inventions, which even to the present day are ascribed to Arkwright by some of the ablest and best-informed persons in the kingdom, belong in great part to other and much less fortunate men. In appropriating those inventions as his own, and claiming them as the fruits of his unaided genius, he acted dishonourably, and left a stain upon his character, which the acknowledged brilliance of his talents cannot efface. Had he been content to claim the merit which really belonged to him, his reputation would still have been high, and his wealth would not have been diminished. That he possessed inventive talent of a very superior order, has been satisfactorily established. And in improving and perfecting mechanical inventions, in exactly adapting them to the purposes for which they were intended, in arranging a comprehensive system of manufacturing, and in conducting vast and complicated concerns, he displayed a bold and fertile mind and consummate judgment; which, when his want of education, and the influence of an employment so extremely unfavourable to mental expansion as that of his previous

life, are considered, must have excited the astonishment of mankind. But the marvellous and "*unbounded invention*" which he claimed for himself, and which has been too readily accorded to him,—the *creative faculty*, which devised all that admirable mechanism—so entirely new in its principles, and characteristic of the first order of mechanical genius—which has given a new spring to the industry of the world, and within half a century has reared up the most extensive manufacture ever known,—*this* did *not* belong to Arkwright. It is clear that some of the improvements which made the carding engine what it was when he took out his second patent, were devised by others; and there are two prior claimants to the invention of spinning by rollers, one of whom had undoubtedly made it the subject of a patent thirty-one years before the patent of Arkwright. I will not venture positively to assert, that the latter derived the principle of his machine either from Wyatt or from Highs; but I must declare my strong conviction, that this was the case, whilst at the same time it is certain that Arkwright displayed great inventive talent in perfecting the details.

The most marked traits in the character of Arkwright were his wonderful ardour, energy, and perseverance. He commonly laboured in his multifarious concerns from five o'clock in the morning till nine at night; and when considerably more than fifty years of age,—feeling that the defects of his education placed him under great difficulty and inconvenience in conducting his correspondence, and in the general management of his business,—he encroached upon his sleep, in order to gain an hour each day to learn English grammar, and another hour to improve his writing and ortho-

graphy! He was impatient of whatever interfered with his favourite pursuits; and the fact is too strikingly characteristic not to be mentioned, that he separated from his wife not many years after their marriage, because she, convinced that he would starve his family by scheming when he should have been shaving, broke some of his experimental models of machinery. Arkwright was a severe economist of time; and, that he might not waste a moment, he generally travelled with four horses, and at a very rapid speed. His concerns in Derbyshire, Lancashire, and Scotland were so extensive and numerous, as to shew at once his astonishing power of transacting business and his all-grasping spirit. In many of these he had partners, but he generally managed in such a way, that, whoever lost, he himself was a gainer. So unbounded was his confidence in the success of his machinery, and in the national wealth to be produced by it, that he would make light of discussions on taxation, and say that *he* would pay the national debt! His speculative schemes were vast and daring; he contemplated entering into the most extensive mercantile transactions, and buying up all the cotton in the world, in order to make an enormous profit by the monopoly: and from the extravagance of some of these designs, his judicious friends were of opinion, that if he had lived to put them in practice, he might have overset the whole fabric of his prosperity!*

* Several of these interesting particulars concerning Sir Richard Arkwright I have received from a private source, on which full reliance may be placed;—a source, I may add, by no means unfavourably disposed to Sir Richard.

CHAPTER X.

THE SPINNING MACHINERY (CONTINUED.)

Invention of the *Mule* by SAMUEL CROMPTON.—Description.—Powers of the mule.—Improved by others.—William Kelly applies water-power to drive the mule.—Crompton takes out no patent; receives a grant from parliament: notice of his life.—Self-acting mule invented by Mr. W. Strutt; also by W. Kelly and others.—The self-acting mule of Roberts; its great success.—Improvements on the water-frame.—The throstle.—The fly frame.—The tube frame.—Retrospective glance at the inventions and improvements in cotton spinning.—The great importance of these inventions.—Unparalleled progress of the Cotton Manufacture.—Cotton wool imported from 1771 to 1790; from 1791 to 1800.—Exports of British manufactured cottons from 1701 to 1800.—Comparative rates of progression in the manufacture before and after the mechanical inventions. Estimated value of the manufacture, and number of cotton mills, mules, jennies, and spindles, in 1787.

DURING the period that has now passed under review, Hargreaves and Arkwright had established the Cotton Manufacture by their spinning machines; but those machines were not adapted for the finer qualities of yarn. The water-frame spun twist for warps, but it could not be advantageously used for the finer qualities, as thread of great tenuity has not strength to bear the pull of the rollers when winding itself on the bobbins.* This defect in the spinning machinery was remedied by the invention of another machine, called the *Mule*, or the *Mule Jenny*, from its combining the principles of Arkwright's water-frame and Hargreaves's

* Encycl. Britannica, article "Cotton Manufacture."

jenny.* Like the former, it has a system of rollers, to reduce the roving; and, like the latter, it has spindles without bobbins to give the twist, and the thread is stretched and spun at the same time by the spindles, after the rollers have ceased to give out the rove. The distinguishing feature of the mule is, that the spindles, instead of being stationary, as in both the other machines, are placed on a moveable carriage, which is wheeled out to the distance of fifty-four or fifty-six inches from the roller-beam, in order to stretch and twist the thread, and wheeled in again to wind it on the spindles. In the jenny, the clasp, which held the rovings, was drawn back by the hand from the spindles; in the mule, on the contrary, the spindles recede from the clasp, or from the roller-beam which acts as a clasp. The rollers of the mule draw out the roving much less than those of the water-frame; and they act like the clasp of the jenny, by stopping and holding fast the rove, after a certain quantity has been given out, whilst the spindles continue to recede for a short distance further; so that the draught on the thread is in part made by the receding of the spindles. By this arrangement, comprising the advantages both of the rollers and the spindles, the thread is stretched more gently and equably, and a much finer quality of yarn can therefore be produced.*

This excellent machine, which has superseded the jenny, and to a considerable extent the water-frame, and which has carried the cotton manufacture to a perfection

* If the adaptation of the lines may be pardoned, for the sake of the exactness with which they apply, it may be said of Crompton's invention, compounded of the two former inventions—

"The force of *genius* could no further go,
To make a *third*, he joined the other *two*."



it could not otherwise have attained, was invented by Samuel Crompton, a weaver, of respectable character and moderate circumstances, living at Hall-in-the-Wood, near Bolton. The date of the invention has been generally stated to be 1775, but Mr. Kennedy, who personally knew Crompton, and who has published an interesting "Memoir" of his life, "with a description of his machine called the 'Mule,' and of the subsequent improvement of the machine by others,"* states that "he was only twenty-one years of age when he commenced this undertaking, which took him five years to effect; at least, before he could bring his improvements to maturity. As the inventor was born in 1753, he must therefore have begun to make his machine in 1774, and completed it in 1779. His own account is decisive: he says in a letter to a friend:—"In regard to the mule, the date of its being first completed was in the year 1779: at the end of the following year I was under the necessity of making it public, or destroying it, as it was not in my power to keep it and work it, and to destroy it was too painful a task, having been four and a half years, at least, wherein every moment of time and power of mind, as well as expense, which my other employment would permit, were devoted to this one end, the having good yarn to weave; so that to destroy it, I could not." Being of a retiring and unambitious disposition, he took out no patent, and only regretted that public curiosity would not allow him "to enjoy his little invention to himself in his garret," and to earn, by his own manual labour, undisturbed, the fruits of his ingenuity and perseverance. The very superior quality of his yarn drew persons from

† Memoirs of the Literary and Philosophical Society of Manchester. Vol. V. second series, p. 318.

all quarters, to ascertain the means whereby he produced it. He stated to Mr. Bannatyne, that on the invention of his machine, "he obtained 14*l*. per lb. for the spinning and preparation of No. 40, (i.e. yarn weighing 40 hanks to the pound,) that a short time after, he got 25s. per lb. for the spinning and preparation of No. 60; and that he then spun a small quantity of No. 80, to shew that it was not impossible, as was supposed, to spin yarn of so fine a grist; and for the spinning and preparation of this he got 42s. per lb."* These prices were commanded by the unrivalled excellence of the yarn; and it affords a criterion to estimate the value of the machine, when it is found that the price of yarn No. 100 is at the present day only from 2s. 3d. to 3s. per lb. including the cost of the raw material, which is 10d. or 1s.—this surprising reduction having been effected chiefly by the powers of the mule; and that, whereas it was before supposed impossible to spin eighty hanks to the pound, as many as *three hundred and fifty* hanks to the pound have since been spun, each hank measuring 840 yards, and forming together a thread a hundred and sixty-seven miles in length!

The invention of the mule was, therefore, another most important improvement in the manufacture—more important than it might have been thought there was room to effect, after the production of the jenny and the water-frame. The mule was not at once perfected. Being much more complicated in its mechanism than either of the other spinning machines, it had cost the inventor five years of experiment and toil; and after all, he produced but a rude piece of workmanship, though the principle was excellent. His first machine consisted of

* Encycl. Britannica, "Cotton Manufacture."

not more than twenty or thirty spindles; his rollers were of wood, and all the parts of his machine were heavy, as might have been expected, seeing that Crompton knew nothing of mechanics, or the use of tools, beyond what he had taught himself in his secluded leisure.* An ingenious mechanic, Henry Stones, of Horwich, who had doubtless seen Arkwright's machine, constructed a mule in a workmanlike manner, making the rollers of

* A high estimate indeed must be formed of the genius of Crompton, if we suppose, as Mr. Kennedy appears to do, that he was altogether ignorant of Arkwright's machine when he invented his own. It is true, that Crompton was himself accustomed to work with one of Hargreaves's jennies, and that his invention bears a greater resemblance to that machine than to the water-frame; but as Arkwright's patent had been taken out *five years* before Crompton *began* the construction of his machine, and *ten years* before he *finished* it, and as the mule includes the rollers moving with different velocities—the very principle of Wyatt's and Arkwright's machines—I cannot suppose that he had not at least heard of this most important contrivance. Mr. Kennedy says—"Mr. Crompton's first suggestion was to introduce a single pair of rollers, viz. a top and a bottom, which he expected would elongate the rove by pressure, like the process by which metals are drawn out, and which he observed in the wire-drawing for reeds used in the loom. In this he was disappointed, and afterwards adopted a second pair of rollers, the latter pair revolving at a slower speed than the former; and thus producing a draught of one inch to three or four. These rollers were put in motion by means of a wooden shaft with different-sized pullies, which communicated with the rollers by a band. This was certainly neither more nor less than a modification of Mr. Arkwright's roller-beam; but he often stated to me, that when he constructed his machine, he knew nothing of Mr. Arkwright's discovery. Indeed, we may infer that he had not, otherwise he would not have gone thus rudely to work; and indeed the small quantity of metals which he employed, proves that he could not have been acquainted with Mr. Arkwright's superior rollers and fixtures in iron, and their connexion by clockwork. Even the rollers were made of wood, and covered with a piece of sheep-skin, having an axis of iron with a little square end, on which the pullies were fixed. Mr. Crompton's rollers were supported upon wooden cheeks or stands. His tops were constructed much in the same way, with something like a mouse-trap spring to keep the rollers in contact. His first machine contained only about 20 or 30 spindles. He finally put dents of brass-reed wire into his under-rollers, and thus obtained a fluted roller. But the great and important invention of Crompton was his spindle carriage, and the principle of the thread having no strain upon it until it was completed. This was the corner-stone of the merits of his invention."—*Brief Memoir of Crompton; Memoirs of Manchester Lit. and Phil. Society*, Vol. V. p. 325.

metal, and applying clockwork to move them; and by his improvements, the mule was adapted for 100 or 130 spindles. Still further improvements were made, within a few years after the invention, by a man named Baker, of Bury, and by one Hargraves, of Toddington. Mr. William Kelly, of Lanark mills, was the first to turn the mule by water-power, in 1790; and when this potent agent was applied, Mr. Wright, a machine-maker, of Manchester, constructed a *double mule*. By these successive additions, the machine was made capable of working with no less than four hundred spindles. Mr. Kennedy himself, from whose "Memoir of Crompton" we collect these particulars, made a considerable improvement in the wheel-work of the mule about 1793, which accelerated the movement of the machine. Of late years, mules have been much increased in size; many are now at work, in Manchester and elsewhere, of eight hundred spindles each, and some of the prodigious number of *eleven hundred* spindles each, or *two thousand two hundred* the pair,—the pair being managed by one spinner.

When the mule first became known, it was called the *Hall-in-the-Wood wheel*, from the place where it was invented, and, shortly after, the *Muslin wheel*, from its making yarn sufficiently fine for the manufacture of muslin; but it ultimately received the name of *Mule*, from combining the principles of the jenny and the water-frame. Mr. Crompton having made no effort to secure by a patent the exclusive enjoyment of his invention, it became public property, and was turned to advantage by more pushing manufacturers, whilst the inventor himself kept on his humble course, receiving no other reward than the very inadequate one of £5,000,



granted him in the year 1812 by parliament.* "The art of spinning on Crompton's machine (says Mr. Kennedy) was tolerably well known, from the circumstance of the high wages that could be obtained by those working on it, above the ordinary wages of other

* The "short and simple annals" of the life of this worthy man—so much resembling the history of many other sons of genius—are thus recorded by Mr. Kennedy, in his "Brief Memoir:"—

"About the year 1802, Mr. G. A. Lee and myself set on foot a subscription for Mr. Crompton, which amounted to about £500; and with this he was enabled to increase his little manufacturing establishment in Bolton, namely, of spinning and weaving. He was prevailed upon also to sit to a London artist for his portrait, which is now in my possession. He was left a widower when his children were very young, and his only daughter kept his little cottage in King-street, Bolton, where he died, and where she is now (1829) living. Being a weaver, he erected several looms for the fancy work of that town, in which he displayed great ingenuity. Though his means were but small, his economy in living made him always in easy circumstances. In 1812, he made a survey of all the cotton districts in England, Scotland, and Ireland, and obtained an estimate of the number of spindles then at work upon his principle, which amounted to between four and five millions.* On his return, he laid the result of his inquiries before Mr. Lee and myself, with a suggestion, that parliament might grant him something. With these data before him, Mr. Lee, who was a warm friend to genius of every kind, with his usual energy entered fully into his merits, and made an appointment with the late George Duckworth, Esq. of Manchester, who also took a lively interest in the scheme, and gratuitously offered to draw up a memorial to parliament in behalf of Mr. Crompton. This was signed by most of the principal manufacturers in the kingdom who were acquainted with his merits. He went to London himself with the memorial, and obtained an interview with one of the members for the county of Lancaster. He remained there during the session, and was in the house on the evening that Mr. Perceval was shot, and witnessed the catastrophe. A short time before this disastrous occurrence, Mr. Perceval had given him a promise to interest himself in his behalf, and, in accordance with this assurance, had brought in a bill, which was passed, for a grant of £5,000 in full, without fees or charges.

"Mr. Crompton was now anxious to place his sons in some business, and fixed upon that of bleaching; but the unfavourable state of the times, the inexperience and mismanagement of his sons, a bad situation, and a misunderstanding with his landlord, which occasioned a tedious lawsuit, conspired in a very short time to put an end to this establishment. His sons then dispersed, and he and his daughter were reduced to poverty. Messrs. Hicks and Rothwell, of Bolton, myself, and some others, in that neighbourhood and in Manchester, had, in 1824, recourse to a

* "Now (in 1829) about seven millions."

artisans, such as shoemakers, joiners, hat-makers, &c., who on that account left their previous employment;* and to them might be applied the fable of the town in a state of siege. For if, in the course of their working the machine, there was any little thing out of gear, each workman endeavoured to fill up the deficiency with some expedient suggested by his former trade; the smith suggested a piece of iron, the shoemaker a welt of leather, &c., all which had a good effect in improving the machine. Each put what he thought best to the experiment, and that which was good was retained. But with all these exertions, there was still very much to learn, for the principle on which the rovings were prepared had little chance of being known, being confined to the principal mill-owners of Mr. Arkwright's patent process of spinning, &c. But the demand for these machines, after the decision of the court of King's Bench, in 1783,† (which I consider very questionable,) soon found makers, and the perseverance of the mule-spinner soon acquired the art."

second subscription, to purchase a life-annuity for him, which produced £63 per annum. The amount raised for this purpose was collected in small sums, from one to ten pounds, some of which were contributed by the Swiss and French spinners, who acknowledged his merits, and pitied his misfortunes. At the same time his portrait was engraved for his benefit, and a few impressions were disposed of: he enjoyed this small annuity only two years. He died January 26th, 1827, leaving his daughter, his affectionate housekeeper, in poverty."

Mr. Crompton was in one respect fortunate, namely, in having met with a gentleman like Mr. Kennedy, who had the heart to befriend merit, and the talent to commemorate it.

* "By their industry, skill, and economy, these men first became proprietors of perhaps a single mule, and, persevering in habits so intimately connected with success, were afterwards the most extensive spinners in the trade."

† The first trial on Arkwright's patent took place in 1781, not 1783, and this trial terminating unfavourably for Arkwright, many persons began to use his carding and roving machines: at this time, probably, the mule came into use: the second and third trials were in 1785.

Even to the present time, the course of improvement has not stopped. Mules have been constructed, which do not require the manual aid of a spinner, the mechanism being so contrived as to roll the spindle-carriage out and in at the proper speed, without a hand touching it; and the only manual labour employed in these machines, which are called *self-acting mules*, is that of the children who join the broken threads. The first machine of this nature was invented by the ingenious Mr. William Strutt, F.R.S., of Derby, son of Mr. Jedediah Strutt, the partner of Arkwright; and the following mention is made of it in a memoir of that gentleman, written by his son, Mr. Edward Strutt, at present Member for Derby. Mr. Strutt died on the 29th of December, 1830, and the memoir appeared shortly after in a periodical journal:—"Among his other inventions and improvements, we may mention a self-acting mule for the spinning of cotton, invented more than forty years ago," [therefore before 1790,] "but we believe the inferior workmanship of that day prevented the success of an invention, which all the skill and improvement in the construction of machinery in the present day has barely accomplished."

Mr. Kelly, formerly of Lanark mills, also made a self-acting mule in 1792; and the following letter from himself to Mr. Kennedy, written on the 8th of January, 1829, and communicated to me by the latter gentleman, contains some interesting particulars concerning Mr. Kelly's improvements—

"I first applied *water-power* to the common mules in the year 1790, that is, we drove the mules by water, but put them up, (that is, the carriage or spindle-frame) in the common way, by applying the hand to the fly-wheel: and by placing the wheels (or mules)

right and left, the spinner was thereby enabled to spin two mules in place of one. * * * *

"The mules at that time were generally driven with ropes made of cotton-mill-waste, from a lying shaft in the middle of the room, and over gallows-pullies above the fly-wheels on each side of the room. That mode of driving was succeeded by belts, which was in every respect much better, and better adapted to self-acting mules, &c. From the above date I constantly had in view the *self-acting mule*, and trying to bring it into use; and having got it to do very well for coarse numbers, I took out the patent in the summer 1792. The object then was, to spin with young people, like the water twist. For that purpose it was necessary that the carriage should be put up without the necessity of applying the hand to the fly-wheel. At first we used them completely self-acting in all the motions—the fly continuing to revolve, and, after receiving the full quantity of twist, the spindles stood—the guide or faller was turned down on the inside of the spindles, and the points were cleared of the thread at the same instant, by the rising of a guide, or inside faller, (if it might be so called.) When the outside guide-wire, or faller, was moved round, or turned down to a certain point on the inside of the spindles, it then disengaged, or or rather allowed a pully, driven from the back of the belt pully, to come into gear or action, and which gave motion to the spindles, and took in the carriage at the same time, (similar to the way you assist the large mules in putting up.) But in the above self-acting mule, which performed every motion, after the spindles were stopped it required about three turns of the fly-wheel to move round the faller, and put in action the above-mentioned pully, that took in the carriage; which was a great loss of time. We therefore set aside that part of the apparatus or machinery, and allowed the mule to stop in the common way on receiving the full complement of twist; and the instant it stopped, the boy or girl, without putting their hand to the fly-wheel, just turned the guide or faller with the hand, which instantly set in motion the spindles, and took in the carriage—the cop being shaped by an inclined plane, or other contrivance. * * *

"It will naturally be asked, why were not the self-acting mules continued in use? At first, you know, the mules were about 144 spindles in size, and when power was applied, the spinner worked

two of such; but the size of the mules rapidly increased to 300 spindles and upwards, and two such wheels being considered a sufficient task for a man to manage, the idea of saving by spinning with boys and girls was thus superseded. * * * *

"I am, dear sir, very respectfully, your obedient servant,

"WILLIAM KELLY."

Several spinners and mechanics in England, Scotland, France, and America have also invented contrivances for the same purpose, amongst whom may be mentioned Messrs. Eaton, of Wilu, in Derbyshire, and of France; Mr. Peter Ewart, of Manchester; Mr. De Iongh, of Warrington; Mr. Buchanan, of the Catrine Works, Scotland; Mr. Knowles, of Manchester; and Dr. Brewster, of America. Of these, none succeeded to any considerable extent, though the self-acting mule of De Iongh has been worked with advantage in several mills.

But the machine which has met with decided success is the self-acting mule invented by Mr. Roberts, an extremely ingenious machine-maker of Manchester, of the firm of Sharp, Roberts, and Co. By this machine, for which the first patent was taken out in 1825, and the second, for a further improvement, in 1830, a very close approach to perfection seems to be made. It produces a considerably greater quantity of yarn, of more uniform twist, and less liable to break, and it winds it on the cop more evenly and closely; so that the yarn is more desirable for the weaver. Roberts's self-acting mule is coming rapidly into use throughout the spinning district. In March, 1834, the patentees informed me that they had then made 520 self-acting mules, containing upwards of 200,000 spindles, and that that number was likely to be more than doubled

in the course of the year. One of the recommendations of this machine to the spinners is, that it renders them independent of the working spinners, whose combinations and stoppages of work have often been extremely annoying to the masters.

Having mentioned one of the most recent improvements on the mule, that of Roberts, I shall now conclude the history of the spinning machinery (though it carries me out of the chronological order) by mentioning the improvements made of late years in the water-frame. This machine seemed at one time to be going out of use, like the jenny,—almost every quality of yarn being spun by the mule. But when the power-loom came into use, it was peculiarly desirable to have twist for warps, of that superior strength and wiry smoothness which the water-frame produces. Improvements which were made in the machine also enabled the manufacturers to sell the water-twist of low counts cheaper than mule-twist. Many years before, the gearing of the water-frame had been simplified, so as to require less power to drive it, and the improved machine was called a *throstle*, probably from its singing sound.

Mr. Bannatyne thus describes this improvement:—"In the throstle, the spinning apparatus is in every respect the same as in Sir Richard Arkwright's frame, but the movement of the parts is different. In place of four or six spindles being coupled together, forming what is called a head, with a separate movement by a pulley and drum, as is the case in the frame, the whole rollers and spindles on both sides of the throstle are connected together, and turned by bands from a tin cylinder lying horizontally under the machine. The merit of the invention chiefly lies in the simplification of

the moving apparatus just mentioned. The movement is not only rendered lighter, but greater facility is afforded for increasing the speed of the machine, and consequently, when the nature of the spinning admits it, for obtaining a larger production. The throstle can also, with more ease, and at less expense, be altered to spin the different grists of yarn; only a few movements require to be changed in it to produce this end, while in the spinning-frame there are a great many."*

Further improvements, which have the effect of increasing the velocity of the spindles, and consequently of augmenting the quantity of twist produced, have been made within the last few years by American mechanics; but these machines cause a large quantity of waste, and they are therefore by no means established in general use as real improvements. Owing to these advantages —the greater quantity of twist produced, its consequent cheapness, and its adaptation to the purpose of warps for power-loom cloth of the coarser kinds—it is probable that the throstles will come into use more extensively than at present.† For all the finer qualities of yarn the mule is the only machine employed.‡

I shall avail myself of Mr. Bannatyne's concise and clear descriptions of two recent improvements in the machines for roving, called the *fly frame* and the *tube frame*—"About the year 1817 the fly frame was intro-

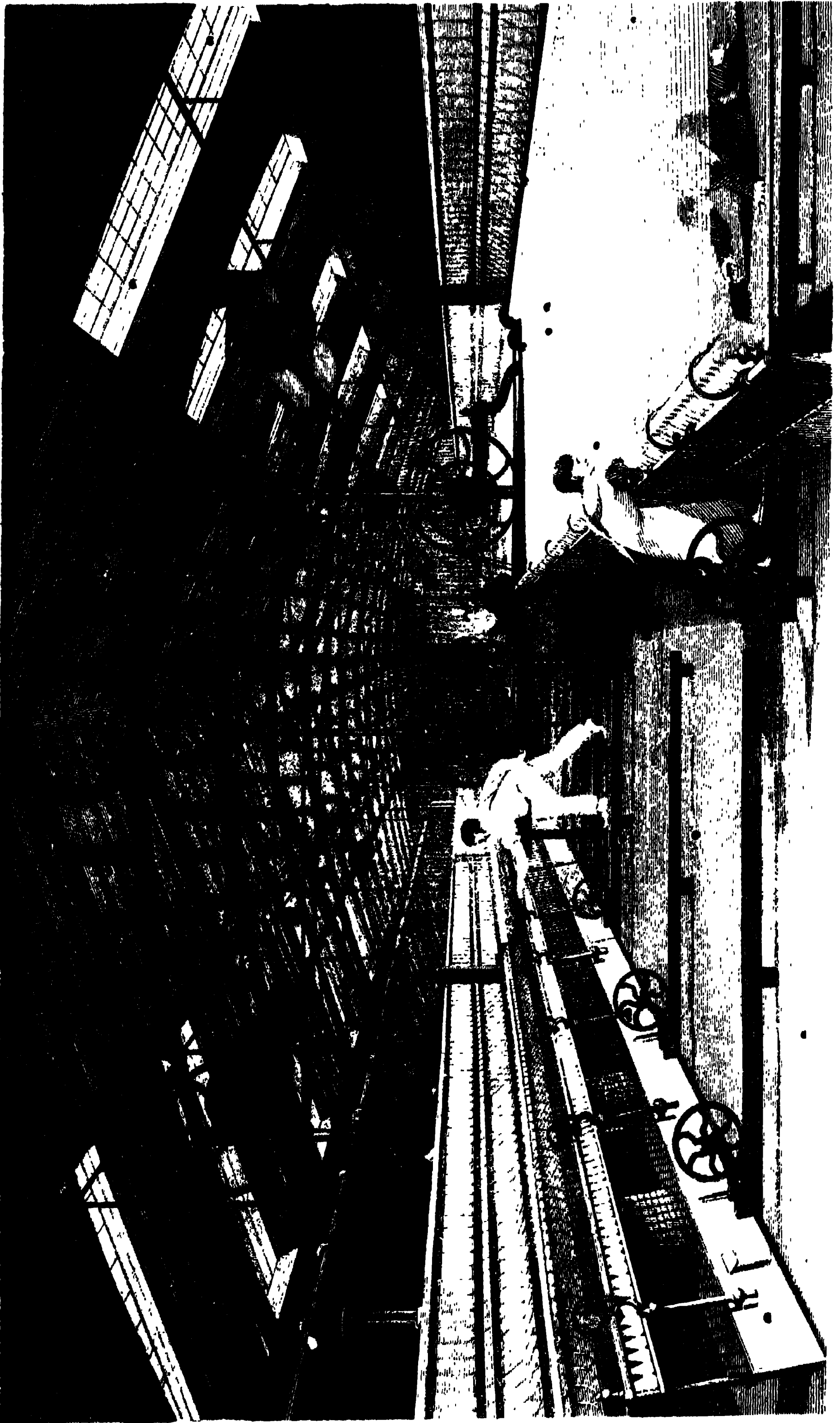
* Encyclopædia Britannica, article "Cotton Manufacture."

† This opinion is strongly expressed in "The Carding and Spinning Master's Assistant; or, The Theory and Practice of Cotton Spinning;" p. 147.

‡ Some idea may be formed of the proportions which these two machines at present bear to each other in the extent of their adoption, from the statement of mule and throstle spindles in Lanarkshire, in November, 1831, made by Dr. Cleland, in his "Enumeration of the Inhabitants of Glasgow," &c. The number of mule spindles is stated to be 591,288, and of throstle spindles 48,900.—p. 151.

duced for preparing rovings for the middle and coarser numbers of both warp and weft; and this machine, having received considerable improvements since, has nearly superseded the use of the roving frame. Instead of the revolving cans of the roving frame, the fly frame has spindles placed at equal distances from each other, with a fly on the top of each, one of the legs of which is made in the form of a tube, for the purpose of receiving the roving and conveying it to the bobbin. The rollers deliver the roving to the top of the fly, where it passes through a small hole immediately above the centre of the spindle, called the eye of the fly, and from which it descends through the tube to the bobbin, which is fitted loosely on the spindle. The fly revolves rapidly round the bobbin, and winds the roving on it as fast as it is delivered by the rollers. The motions of the rollers and spindles are equal and uniform at all times: hence the twist is equally diffused over all parts of the roving. But to adapt the taking up of the roving to the uniform delivery of the rollers, the speed of the bobbin must be variable and unequal; for, while it increases in diameter, the velocity of its acting circumference will remain the same. The ratio of its accelerating motion, therefore, must be equal to the ratio of its increasing diameter; that is, supposing the bobbin to follow the fly; but sometimes the fly follows the bobbin, in which case the speed of the bobbin must decrease in the same ratio as above.

"An important improvement in the process of preparation for cotton spinning is the tube frame lately introduced. It is employed as a finishing frame for coarse numbers; but when used as a slabbing or roving frame, it may be applied to the preparation of yarns of



any number whatever. The construction of this machine differs from that of the roving frame, in having, instead of cans, revolving horizontal cylinders parallel with the beam rollers, placed about twelve inches in front of the beam. Its chief advantage lies in the great quantity of roving it can produce in a given time, its superiority of production to the fly frame being as eighty-four to seventeen; but the rove it produces is inferior in quality, and, having no twist, is extremely soft and tender, and causes a greater quantity of waste than the roves prepared by the fly frame."*

A person named Green, a tinsmith, of Mansfield, was the first who conceived the idea of attaching the movements of the spindle and bobbin together, so as to regulate the sp[illegible] latter in proportion to that of the former, as is done in the fly frame; but Mr. Henry Houldsworth, the cotton spinner, of Manchester, invented the combination of wheels, by which that object is accomplished, and took out a patent for it in 1825. Mr. Dyer, of Manchester, introduced the tube frame from America, and is the patentee in this country; he obtained the first patent in 1825, and the second, for an improvement of his own, in 1829: the machine has been brought into very extensive use: in 1833 not less than a thousand of the tube frames were in operation, each of them capable of working 1000 lbs. of cotton per week.

Having thus traced the spinning machinery up to the present time, let us pause, to cast a retrospective glance on the different stages by which the process of spinning has advanced, from the time when the one-thread wheel was in general use. Little more than sixty years since,

* Encyclopædia Britannica, article "Cotton Manufacture."

every thread used in the manufacture of cotton, wool, worsted, and flax, throughout the world, was spun singly by the fingers of the spinner, with the aid of that *classical* instrument, the domestic spinning wheel. In 1767, an *eight-handed* spinster sprung from the genius of Hargreaves; and the *jenny*, with still increasing powers, made its way into common use, in spite of all opposition. Two years afterwards, the more wonderful invention of Wyatt, which claims a much earlier origin, but which had disappeared, like a river that sinks into a subterraneous channel, and now rose again under the fortunate star of Arkwright, claimed yet higher admiration, as founded on principles of more extensive application. Five years later, the happy thought of combining the principles of these two inventions, to produce a third much more efficient than either, struck the mind of Crompton, who, by a perfectly original contrivance, effected the union. From twenty spindles, this machine was brought, by more finished mechanism, to admit of a hundred spindles, and thus to exercise a Briarean power. Kelly relinquished the toilsome method of turning the machine by hand, and yoked to it the strength of the rapid Clyde. Watt, with the subtler and more potent agency of steam; moved an iron arm that never slackens or tires, which whirls round two thousand spindles in a single machine. Finally, to consummate the wonder, Roberts dismisses the spinner, and leaves the machine to its own infallible guidance. So that, in the year 1831, several thousand spindles may be seen in a single room, revolving with inconceivable rapidity, with no hand to urge their progress or to guide their operations—drawing out, twisting, and winding up as many thousand threads, with unfailing precision, inde-

fatigable patience and strength;—a scene as magical to the eye which is not familiarized with it, as the effects have been marvellous in augmenting the wealth and population of the country.

If the thought should cross any mind, that, after all, the so much vaunted genius of our mechanics has been expended in the insignificant object of enabling men better to pick out, arrange, and twist together the fibres of a vegetable wool,—that it is for the performance of this minute operation that so many energies have been exhausted, so much capital employed, such stupendous structures reared, and so vast a population trained up; —we reply—An object is not insignificant, because the operation by which it is effected is *minute:* the first want of men in this life, after food, is *clothing*, and as *this* art enables them to supply it far more easily and cheaply than the old methods of manufacturing, and to bring cloths of great elegance and durability within the use of the humble classes, it is an art whose utility is inferior only to that of agriculture. It contributes directly and most materially to the comforts of life among all nations where manufactures exist, or to which the products of manufacturing industry are conveyed; it ministers to the comfort and decency of the poor, as well as to the taste and luxury of the rich. By supplying one of the great wants of life with a much less expenditure of labour than was formerly needed, it sets at liberty a larger proportion of the population, to cultivate literature, science, and the fine arts. To this country, the new inventions have brought a material accession of wealth and power. When it is also remembered that the inventions, whose origin I have endea-

voured carefully to trace, are not confined in their application to one manufacture, however extensive, but that they have given nearly the same facilities to the woollen, the worsted, the linen, the stocking, and the lace manufactures, as to the cotton; and that they have spread from England to the whole of Europe, to America, and to parts of Africa and Asia; it must be admitted that the mechanical improvements in the art of spinning have an importance which it is difficult to over-estimate. By the Greeks, their authors would have been thought worthy of deification; nor will the enlightened judgment of moderns deny that the men to whom we owe such inventions deserve to rank among the chief benefactors of mankind.

The dissolution of Arkwright's patent, and the invention of the mule, concurred to give the most extraordinary impetus to the cotton manufacture. Nothing like it has been known in any other great branch of industry. Capital and labour rushed to this manufacture in a torrent, attracted by the unequalled profits which it yielded. Numerous mills were erected, and filled with water-frames; and jennies and mules were made and set to work with almost incredible rapidity. The increase of weavers kept pace with the increase of spinners; and all classes of workmen in this trade received extravagantly high wages; such as were necessary to draw from other trades the amount of labour for which the cotton trade offered profitable employment, but such as it was impossible to maintain for any lengthened period.

Within ten years, from 1780 to 1790, the quantity of cotton consumed in this country increased nearly *five-fold*, as appears from the following table:—

COTTON IMPORTED FROM 1771 TO 1790.

Years.	lbs.	Years.	lbs.
Average {1771 to 1775	4,764,589	1785	18,400,384
Average {1776 to 1780	6,766,613	1786	19,475,020
1781	5,198,778	1787	23,250,268
1782	11,828,039	1788	20,467,436
1783	9,735,663	1789	32,576,023
1784	11,482,083	1790	31,447,605

It may be interesting to cast a glance over the whole century, and to compare the slow progress of the manufacture before the mechanical improvements with its rapid progress afterwards, as indicated by the consumption of the raw material, and the exportation of the manufactured article. The following tables have been supplied from the Custom-House:—

COTTON IMPORTED FROM 1701 TO 1800.

Years.	lbs.	Years.	lbs.
1701	1,985,868	1751	2,976,610
1701 to 1705 (average)	1,170,881	1764	3,870,392
1710	715,008	Average {1771 to 1775	4,764,589
1720	1,972,805	Average {1776 to 1780	6,766,613
1730	1,545,472	1790	31,447,605
1741	1,645,031	1800	56,010,732

BRITISH COTTONS EXPORTED FROM 1701 TO 1800.

Official Value.

Years.	£.	Years.	£.
1701	23,253	1764	200,354
1710	5,698	1766	220,759
1720	16,200	1780	355,060
1730	13,524	1787	1,101,457
1741	20,709	1790	1,662,369
1751	45,986	1800	5,406,501

Within the *first fifty* years of the century, the quantity of cotton wool imported seems to have little more than *doubled:* within the *last twenty* years, it multiplied more than *eight-fold.* The rate of progression, therefore, was *ten* times as great in the latter period as in the former!

Within the *first fifty* years, the value of the cotton exports nearly *doubled:* within the *last twenty* it multiplied *fifteen and a half fold.* The rate of progression, therefore, was nearly *twenty* times as great in the latter period as in the former! Such are the effects of Machinery!

The purposes for which the cotton was used, in the year 1787, are thus stated:—

	lbs.
Calicoes and Muslins	11,600,000
Fustians	6,000,000
Mixtures with Silk and Linen . . .	2,000,000
Hosiery	1,500,000
Candle-wicks*	1,500,000
	22,600,000

Estimates of the extent and value of the cotton trade were made in a pamphlet, published in 1788, entitled, "An important Crisis in the Calico and Muslin Manufactures of the Country explained." These estimates have been copied into many other works,† but they

* The quantity here set down for candle-wicks is nearly as great as the whole importation of cotton at the beginning of the century. I have no means of ascertaining whether the estimate (which appears in a pamphlet published at the time, but, as will be seen, having little pretensions to accuracy,) is correct; but if it even approaches to correctness, it leads us to the inference that a considerable proportion, even of the small imports of 1700 to 1750, may have been used as candle-wicks, and for other minor purposes.

† Amongst others, into Aikin's History of Manchester, Macpherson's Annals of Commerce, Bryan Edwards's History of the West Indies, and Rees's Cyclopædia.

are preposterously exaggerated. They represent the whole value of the cotton manufacture, including both raw material and labour, to have been only £200,000 in 1767, and to have risen to £7,500,000 in 1787; which would have shewn an increase of more than *thirty-seven fold,* whilst the increase in the quantity of the raw material consumed was certainly not *seven-fold!*

The amounts given both for 1767 and 1787 are incorrect, the former being as much under-rated as the latter is over-rated. The official return just quoted shews that the cotton *exports* in 1766 were £220,759; and, in the same year, Postlethwayt estimated the whole value of the cotton goods *manufactured* in England at £600,000: these two statements would shew that the exports were then nearly in the proportion of *one-third* of the whole value manufactured. At the present time the exports are about one-half of the whole value manufactured. But suppose that they continued in the same proportion in 1787 as in 1766, that is, one-third: the official value of the cotton exports in 1787 was £1,101,457; which, multiplied by three, would give £3,304,371 as the whole value of the cottons manufactured in England. The matter will then stand thus:—

Even Dr. Percival, of Manchester, suffered himself to be deluded by this pamphlet, which was got up in a hurry to assist a popular clamour against the admission of India cotton goods; and he copied from it (with acknowledgment) into his "Observations on Population," the statement which has ever since been fathered upon himself, namely, that "in 1760 the entire value of all the cotton goods manufactured in Great Britain was estimated to amount only to £200,000 a year," (*ante*, p. 110.) It is amusing to trace the progress of these gross errors, which have probably been copied on trust by hundreds of authors, though they originated in an ephemeral brochure,—a mere budget of blunders and prejudices.

VALUE OF ENGLISH COTTON MANUFACTURES IN 1767 AND 1787.

Erroneous Estimate.			Corrected Estimate.		
1767	£200,000	An increase of 37 fold.	1766	£600,000	An increase of 5½ fold.
1787	7,500,000		1787	3,304,371	

Instead of an increase of 37 fold, we see therefore an increase of 5½ fold; the reality is sufficiently striking, without the aid of exaggeration.

The pamphlet above quoted also calculates the number of men, women, and children, employed in all the stages of the cotton manufacture, in the year 1787, as being 350,000; which is equally incredible, if compared with the small population which must have been engaged in the manufacture twenty years before, or with the population it employs at the present time, when the quantity of cotton consumed is thirteen times as great as in 1787 Mr. M'Culloch, in 1831, estimated the number of weavers, spinners, bleachers, &c. employed in the cotton trade in Great Britain, at 833,000,* which is probably near the truth; but it cannot be supposed that the number of persons in the trade only little more than doubled within the forty-four years, from 1787 to 1831, when the consumption of the raw material increased eleven-fold during the same period. At the beginning of the year 1785, Mr. Pitt, when defending the new cotton duty, estimated the number of persons employed in all branches of the cotton manufacture at 80,000.† As this estimate was made immediately after a searching

* M'Culloch's Dictionary of Commerce and Commercial Navigation, p. 415.

† Hansard's Parliamentary Debates, April 20, 1785.

parliamentary investigation into the condition of the cotton manufacture, it is likely to have been tolerably accurate; but it was the estimate for the year 1784, when the importation of cotton was only 11,482,083 lbs., not for 1785. In 1787—the interval having been a period of the most extraordinary increase—the quantity of cotton imported was 23,250,268 lbs. Suppose, then, that the number of hands increased in proportion to the increase in the consumption of the raw material; and from these elements of calculation we should find that the hands employed in the cotton manufacture in 1787 were 162,000.

It is probable that the statement of the number of cotton-mills made in this pamphlet, would approach to correctness. It is as follows:—

Number of Cotton-Mills in Great Britain, in 1787.

In Lancashire	41	Flintshire	3
Derbyshire	22	Pembrokeshire	1
Nottinghamshire	17	Lanarkshire	4
Yorkshire	11	Renfrewshire	4
Cheshire	8	Perthshire	3
Staffordshire	7	Edinburghshire	2
Westmoreland	5	Rest of Scotland	6
Berkshire	2	Isle of Man	1
Rest of England	6		
			24

In England	119
In Scotland, Wales, and Isle of Man	24
	143

CHAPTER XI.

THE STEAM-ENGINE, POWER-LOOM, ETC

Disadvantages of water-power.—The steam-engine.—History of the steam-engine; Solomon de Caus, David Ramseye, Marquis of Worcester, Captain Savery, Newcomen, Beighton.—James Watt studies to remedy the defects of the steam-engine: succeeds.—His patent in 1769.—Brilliant era of British science and invention.—Watt connects himself with Boulton.—Act to secure his patent for 25 years.—His improvements described.—First reciprocating engine erected in 1782.—Applied to cotton spinning.—Great importance of the steam-engine.—Improvements in weaving.—History of the power-loom.—Rev. Dr. Cartwright.—Dressing machine of Johnson and Radcliffe.—Power-loom succeeds.—Number of power-looms in Great Britain.—The willow, scutching machine, and spreading machine.—Review of the processes of manufacturing.—The cotton mill a grand triumph of science.

Amazing as is the progress which had taken place in the cotton manufacture prior to 1790, it would soon have found a check upon its further extension, if a power more efficient than water had not been discovered to move the machinery. The building of mills in Lancashire must have ceased, when all the available fall of the streams had been appropriated. The manufacture might indeed have spread to other counties, as it has done to some extent; but it could not have flourished in any district where coal as well as water was not to be found; and the diffusion of the mills over a wide space would have been unfavourable to the division of labour, the perfection of machine-making, and the cheapness of conveyance.

At this period a power was happily discovered, of almost universal application and unlimited extent, adapted to every locality where fuel was cheap, and available both to make machines and to work them, both to produce goods, and to convey them by land and water. This power was the *steam-engine*, which, though not an invention of that age, was first made of great and extensive utility by the genius of James Watt.

The first thought of employing the expansive force of steam as a mechanical power is believed to have been entertained by Solomon de Caus, engineer to Louis XIII., who proposed the raising of water by steam as a philosophical principle, in a book written in 1615, after he had been in England, in the suite of the Elector Palatine, who married the daughter of James I. In 1630, Charles I. granted a patent to David Rámseye, a groom of the privy chamber, for nine articles of invention, two of which seem to indicate the origin of the steam-engine, viz.: "To raise water from low pitts, by fire;" and "To raise water from low places, and mynes, and coal pits, by a new waie never yet in use."* These facts take away from the ingenious Marquis of Worcester the honour which has generally been ascribed to him, of having first applied steam as a mechanical power. In the "*Century of Inventions*," published by that eccentric nobleman in 1663, there is the most distinct statement of the immense power of steam, which he had proved by its bursting a cannon, and which he had applied to the producing of fountains forty feet high. The first person who constructed a machine in which steam was successfully turned to purposes of usefulness, was Captain

* Rymer's Fœdera, Vol. XIX. p. 139.

Savery,* who obtained a patent on the 25th July, 1698, for his invention. This engine was thought of so much importance, that an act of parliament was passed, 10 and 11 William III. c. 31, "for the encouragement of a new invention, by Thomas Savery, for raising water, and occasioning motion to all sorts of mill-work, by the impellent force of fire." Before he obtained his patent, Savery had erected several steam-engines to pump water out of the Cornish mines, and had published a description of the machine in a book, entitled "*The Miner's Friend*," in 1696. This engine, though very ingenious, had many defects, the principal of which were, that it occasioned a great waste of steam and fuel, and, from its limited powers, could only be applied in certain situations. A material improvement was made in it by Thomas Newcomen, an ingenious ironmonger at Dartmouth, in Devonshire, who came to an agreement with Savery, and obtained a joint patent with him for the new engine in 1705. Mr. Beighton, in 1717, simplified the movements of the machine, without changing its principle; and, after his time, no considerable improvement was made till 1769.

James Watt, a native of Greenock, was brought up as a maker of philosophical instruments in Glasgow and London, and settled in Glasgow in 1757. He was appointed instrument maker to the university, and thus became acquainted with Dr. Black, professor of medicine and lecturer on chemistry in that institution, who, about this time, published his important and beautiful discovery of latent heat. The knowledge of this doctrine led Watt to reflect on the prodigious waste of heat in the steam-

* Savery obtained the title of Captain, by which he is always known, from the Cornish miners, who are in the habit of giving it to the head engineers.

engine, where steam was used merely for the purpose of creating a vacuum in the cylinder under the piston, and for that end was condensed in the cylinder itself,—the piston being then forced down solely by atmospheric pressure. The cylinder was therefore alternately warmed by the steam, and cooled by the admission of cold water to condense the steam; and when the steam was readmitted after the cooling process, much of it was instantly condensed by the cold cylinder, and a great waste of the steam took place: of course, there was an equal waste of the fuel which produced the steam, and this rendered the use of the machine very costly.

It happened that Watt was employed, in the year 1763, to repair a small working model of Newcomen's steam-engine for Professor Anderson. He saw its defects, and studied how to remedy them. He perceived the vast capabilities of an engine, moved by so powerful an agent as steam, if that agent could be properly applied. His scientific knowledge, as well as his mechanical ingenuity, was called forth; all the resources of his sagacious and philosophical mind were devoted to the task; and after years of patient labour and costly experiments, which nearly exhausted his means, he succeeded in removing every difficulty, and making the steam-engine the most valuable instrument for the application of power, which the world has ever known.

It is not a little remarkable that his patent, "for lessening the consumption of steam and fuel in fire engines," should have been taken out in the same year as Arkwright's patent for spinning with rollers, namely, 1769—one of the most brilliant eras in the annals of British genius;—when Black and Priestley were making their great discoveries in science; when Har-

greaves, Arkwright, and Watt revolutionized the processes of manufactures; when Smeaton and Brindley executed prodigies of engineering art; when the senate was illuminated by Burke and Fox, Chatham and Mansfield; when Johnson and Goldsmith, Reid and Beattie, Hume, Gibbon, and Adam Smith, adorned the walks of philosophy and letters.

The patent of 1769 did not include all Watt's improvements. He connected himself in 1775 with Mr. Boulton, of Soho, Birmingham, a gentleman of wealth, enterprise, and mechanical talent; and, having made still further improvements in the steam-engine, an Act of parliament was passed the same year, vesting in him "the sole use and property of certain steam-engines (or fire-engines) of his invention, throughout his majesty's dominions," for the extraordinary term of twenty-five years.* So comprehensive was the Act, that it prevented others from making steam-engines which contained improvements of their own, if their engines condensed the steam in a separate vessel: this was the foundation of Watt's improvements, and it was so great an improvement, that no person could without immense

* The reasons for this great favour shewn to Mr. Watt are thus stated in the act: "James Watt has expended great part of his fortune in making experiments to improve steam-engines; but on account of the difficulties in execution, could not complete his invention before the end of 1774, when he finished some large engines, which have succeeded. In order to make those engines with accuracy, at moderate prices, a large sum must be previously expended in mills and apparatus; and as several years and repeated proofs will be required before the public can be fully convinced of their interest to adopt the invention, the term of the patent may elapse before he is recompensed. By furnishing mechanical power at less expense, and in more convenient forms than hitherto, his engines may be of great utility in many great works and manufactures, yet he cannot carry his invention into that complete execution that will render it of the highest utility of which it is capable, unless the term be prolonged, and his property in the invention secured in Scotland, as well as in England and the colonies."

disadvantage dispense with it. Watt, therefore, took up his position in a narrow pass, which he was able to defend against a host; and he kept the whole business of making steam-engines to himself, deterring all invaders of his privilege by instantly commencing prosecutions. He enjoyed his patent for more than thirty years, from 1769 to 1800: and, though it was probably unproductive for the first ten years, it afterwards produced him a large fortune, so that he retired from business a wealthy man, on the expiration of the exclusive privilege. The monopoly was much more extended than any legislature ought to have granted; but it must be allowed that no man could have better deserved or better used it.

Watt laboured incessantly to perfect this important and complicated engine, and took out three other patents in 1781, 1782, and 1784, for great and essential improvements. The three great improvements which he made in the steam-engine are thus briefly described: 1st. The condensation of the steam in a separate vessel: this increased the original powers of the engine, giving to the atmospheric pressure, and to the counter-weight, their full energy, while, at the same time, the waste of steam was greatly diminished. 2d. The employment of steam pressure, instead of that of the atmosphere: this accomplished a still further diminution of the waste, and was fertile in advantages, as it rendered the machine more manageable, particularly by enabling the operator at all times, and without trouble, to suit the power of the engine to its load of work, however variable and increasing. The third improvement was the double impulse, which may be considered as the finishing touch

given to the engine, by which its action is rendered nearly as uniform as the water-wheel.

Up to the time of Watt, and indeed up to the year 1782, the steam-engine had been almost exclusively used to pump water out of mines. He perfected its mechanism, so as to adapt it to the production of rotative motion and the working of machinery; and the first engine of that kind was erected by Boulton and Watt at Bradley iron-works, in that year. The first engine which they made for a cotton mill was in the works of Messrs. Robinsons, of Papplewick, in Nottinghamshire, in the year 1785. An atmospheric engine had been put up by Messrs. Arkwright and Simpson for their cotton mill on Shude-hill, Manchester, in 1783: but it was not till 1789 that a steam-engine was erected by Boulton and Watt in that town for cotton spinning, when they made one for Mr. Drinkwater: nor did Sir Richard Arkwright adopt the new invention till 1790,—when he had one of Boulton and Watt's engines put up in a cotton mill at Nottingham. In Glasgow, the first steam-engine for cotton spinning was set up for Messrs. Scott and Stevenson, in 1792. So truly had it been predicted in the Act of 1775, that "several years, and repeated proofs, would be required before the public would be fully convinced of their interest to adopt the invention." But when the unrivalled advantages of the steam-engine, as a moving force for all kinds of machinery, came to be generally known, it was rapidly adopted throughout the kingdom, and for every purpose requiring great and steady power. The number of engines in use in Manchester, before the year 1800, was probably 32, and their power 430 horse;

and at Leeds there were 20 engines, of 270 horse-power.*

By some writers, who have not remarked the wonderful spring which had been given to the cotton manufacture before the steam-engine was applied to spinning machinery, too great stress has been laid upon this engine, as if it had almost created the manufacture. This was not the case. The *spinning machinery* created the cotton manufacture. But this branch of industry has unquestionably been extended by means of the steam-engine far beyond the limit which it could otherwise have reached; and now the steam-engine stands in the same relation to the spinning machines, as the heart does to the arms, hands, and fingers, in the human frame;† the latter perform every task of dexterity and labour, the former supplies them with all their vital energy. Without the steam-engine, Manchester and Glasgow would not have approached to their present greatness.‡

* Farey on the Steam Engine, p. 654.

† Voilà la plus merveilleuse de toutes les machines; le mécanisme ressemble à celui des animaux. La chaleur est le principe de son mouvement; il se fait dans ses différens tuyaux une circulation, comme celle du sang dans les veines, ayant des valvules qui s'ouvrent et se ferment àpropos; elle se nourrit, s'évacue d'elle-même dans des temps réglés, et tire de son travail tout ce qu'il lui faut pour subsister."—*Belidor, Architecture Hydraulique.*

‡ Mr. Kennedy makes the following remarks on the effects of the steam-engine, in his paper "On the Rise and Progress of the Cotton Trade:"—"About this time (1790) Mr. Watt's steam-engine began to be understood and introduced into this part of the kingdom, and it was applied to the turning of these various machines, (the spinning machinery.) In consequence of this, waterfalls became of less value; and, instead of carrying the people to the power, it was found preferable to place the power among the people, wherever it was most wanted. The introduction of this admirable machine imparted new life to the cotton trade. Its inexhaustible power, and uniform regularity of motion, supplied what was most urgently wanted at the time; and the scientific principles and excellent workmanship displayed in its construction, led those who were interested in this trade to make many and great improvements in their machines and apparatus for bleaching,

The spirit of improvement, which had carried the spinning machinery to so high a degree of perfection, was next directed to the *weaving* department, and did not rest till that operation, as well as spinning, was performed by machinery. A loom, moved by water-power, had been contrived by M. de Gennes so far back as the seventeenth century; it is described in the Philosophical Transactions of the Royal Society for 1678, (vol. II. p. 439, of Dr. Hutton's Abridgment,) as "a new engine to make linen cloth without the help of an artificer;" and the description given of its advantages deserves to be quoted, from the resemblance between the advantages which that loom professed to attain, and those which the modern power-loom actually does attain:—

"The advantages of this machine are these:—1. That one mill alone will set ten or twelve of these looms at work. 2. The cloth may be made of what breadth you please, or at least much broader than any which has been hitherto made. 3. There will be fewer knots in the cloth, since the threads will not break so fast as in other looms, because the shuttle that breaks the greater part can never touch them. In short, the work will be carried on quicker and at less expense, since, instead of several workmen, which are required in making of very large cloths, one boy will serve to tie the threads of several looms as fast as they break, and to order the quills in the shuttle."

dyeing, and printing, as well as for spinning. Had it not been for this new accession of power and scientific mechanism, the cotton trade would have been stunted in its growth, and, compared with its present state, must have become an object only of minor importance in a national point of view. And, I believe, the effects of the steam-engine have been nearly the same in the iron, woollen, and flax trades."—Memoirs of the Literary and Philosophical Society of Manchester, vol. III. second series, p. 127.

It is probable that this machine, from its unwieldy construction, did not secure in practice the advantages which it promised in theory, as it is not known to have ever come into use. About the middle of the eighteenth century, a swivel-loom was invented by M. Vauconson; and in 1765 a weaving factory, probably filled with those looms, was erected by Mr. Gartside, at Manchester; but no advantage was realized, as a man was required to superintend each loom.

In 1785 the Rev. Dr. Edmund Cartwright, of Hollander-house, Kent, (brother of Major Cartwright, the well-known advocate of radical reform,) invented a power-loom, which may be regarded as the parent of that now in use. The circumstances which led to the invention have been thus described in a letter from himself to Mr. Bannatyne, inserted in the Encyclopædia Britannica:—

"Happening to be at Matlock in the summer of 1784, I fell in company with some gentlemen of Manchester, when the conversation turned on Arkwright's spinning machinery. One of the company observed, that as soon as Arkwright's patent expired, so many mills would be erected, and so much cotton spun, that hands never could be found to weave it. To this observation I replied, that Arkwright must then set his wits to work to invent a weaving mill. This brought on a conversation on the subject, in which the Manchester gentlemen unanimously agreed that the thing was impracticable; and, in defence of their opinion, they adduced arguments which I certainly was incompetent to answer, or even to comprehend, being totally ignorant of the subject, having never at that time seen a person weave. I controverted, however, the impracticability of the thing by remarking, that there had lately been exhibited in London an automaton figure which played at chess. Now you will not assert, gentlemen, said I, that it is more difficult to construct a machine that shall weave, than one which

shall make all the variety of moves which are required in that complicated game.

"Some little time afterwards, a particular circumstance recalling this conversation to my mind, it struck me that, as in plain weaving, according to the conception I then had of the business, there could only be three movements, which were to follow each other in succession, there would be little difficulty in producing and repeating them. Full of these ideas, I immediately employed a carpenter and smith to carry them into effect. As soon as the machine was finished, I got a weaver to put in the warp, which was of such materials as sail-cloth is usually made of. To my great delight, a piece of cloth, such as it was, was the produce. As I had never before turned my thoughts to any thing mechanical, either in theory or practice, nor had ever seen a loom at work, or knew any thing of its construction, you will readily suppose that my first loom was a most rude piece of machinery. The warp was placed perpendicularly, the reed fell with the weight of at least half a hundred-weight, and the springs which threw the shuttle were strong enough to have thrown a Congreve rocket. In short, it required the strength of two powerful men to work the machine at a slow rate, and only for a short time.' Conceiving, in my great simplicity, that I had accomplished all that was required, I then secured what I thought a most valuable property, by a patent, 4th of April, 1785. This being done, I then condescended to see how other people wove; and you will guess my astonishment, when I compared their easy modes of operation with mine. Availing myself, however, of what I then saw, I made a loom, in its general principles nearly as they are now made. But it was not till the year 1787 that I completed my invention, when I took out my last weaving patent, August 1st of that year."

Dr. Cartwright was led by his invention to undertake manufacturing with power-looms at Doncaster; but the concern was unsuccessful, and he at length abandoned it. He afterwards obtained other patents for wool-combing, in which he was as unfortunate as in his power-loom, although an Act was passed in 1801, prolonging the latter patents. Though he had a handsome

paternal fortune, his affairs became inextricably embarrassed; but he was more fortunate than most inventors, in obtaining from parliament, in 1809, a grant of £10,000, as a reward for his ingenuity.

About 1790, Messrs. Grimshaw, of Gorton, under a licence from Dr. Cartwright, erected a weaving factory at Knott Mills, Manchester, and attempted to improve the power-loom, at great cost to themselves. They did not succeed; and, the factory being burnt down, they abandoned the undertaking. In 1794, a power-loom was invented by Mr. Bell, of Glasgow, which was likewise abandoned. On the 6th of June, 1796, Mr. Robert Miller, of Glasgow, took out a patent for a machine of this nature; which a spirited individual, Mr. John Monteith, adopted in 1801, and fitted up a mill at Pollokshaws, Glasgow, with two hundred looms. It was several years before the business was made to answer.

The great obstacle to the success of the power-loom was, that it was necessary to stop the machine frequently, in order to dress the warp as it unrolled from the beam; which operation required a man to be employed for each loom, so that there was no saving of expense. This difficulty was happily removed, by the invention of an extremely ingenious and effectual mode of dressing the warp *before* it was placed in the loom.

The dressing-machine was produced by Messrs. Radcliffe and Ross, cotton manufacturers, of Stockport, but they took out the patent in the name of Thomas Johnson, of Bredbury, a weaver in their employment, to whose inventive talent the machine was chiefly owing. Mr. William Radcliffe, who had conceived the utmost alarm at the consequences of exporting cotton-yarn, and who

spent a considerable part of his life in endeavours to prevent it, justly thought that the most effectual way of securing for this country the manufacturing of the yarn, was to enable the English to excel as much in weaving as they did in spinning. He saw the obstacles to the accomplishment of this object, but, being a man of determined purpose, he shut himself up in his mill, on the 2d of January, 1802, with a number of weavers, joiners, turners, and other workmen, and resolved to produce some great improvement. Two years were spent in experiments. He had for his assistant Thomas Johnson, an ingenious but dissipated young man, to whom he explained what he wanted, and whose fertile invention suggested a great variety of expedients, so that he obtained the name of the "conjuror" among his fellow-workmen. Johnson's genius, and Radcliffe's judgment and perseverance, at length produced the dressing-machine; an admirable invention, without which the power-loom could scarcely have been rendered efficient.

The process is thus briefly described:—"The yarn is first wound from the cop upon bobbins, by a winding-machine, in which operation it is passed through water, to increase its tenacity. The bobbins are then put upon the warping-mill, and the web warped from them upon a beam belonging to the dressing-frame. From this beam, placed now in the dressing-frame, the warp is wound upon the weaving-beam, but, in its progress to it, passes through a hot dressing of starch. It is then compressed between two rollers, to free it from the moisture it had imbibed with the dressing, and drawn over a succession of tin cylinders heated by steam, to dry it; during the whole of this last part of its progress

being lightly brushed as it moves along, and fanned by rapidly revolving fanners."* The dressing here spoken of is merely a size or paste made of flour and water,† now generally used cold; and the use of it is, to make the minute fibres, which, as it were, feather the yarn, adhere closely to it, so that the warp may be smooth like catgut. The brushes essentially aid in smoothing the yarn, and distributing the size equally over it; and by means of the fan and the heated cylinders the warp is so soon dried, that it is wound upon the beam for the loom within a very short space after passing through the trough of paste. This machine, from the regularity and neatness of its motions, and its perfect efficacy, is equally beautiful and valuable.

Radcliffe and his partner took out four patents in the years 1803 and 1804; two of them for a useful improvement in the loom,—the taking up of the cloth by the motion of the lathe; and the other two for the new mode of warping and dressing. Johnson, in whose name they were taken out, received by deed the sum of £50 in consideration of his services, and continued in their employment. Radcliffe's unremitted devotion to the perfecting of this apparatus, and other unfortunate circumstances, caused the affairs of his concern to fall into derangement. He failed twice or three times; and he was as unsuccessful in his well-meant, but foolish and pertinacious opposition to the exporta-

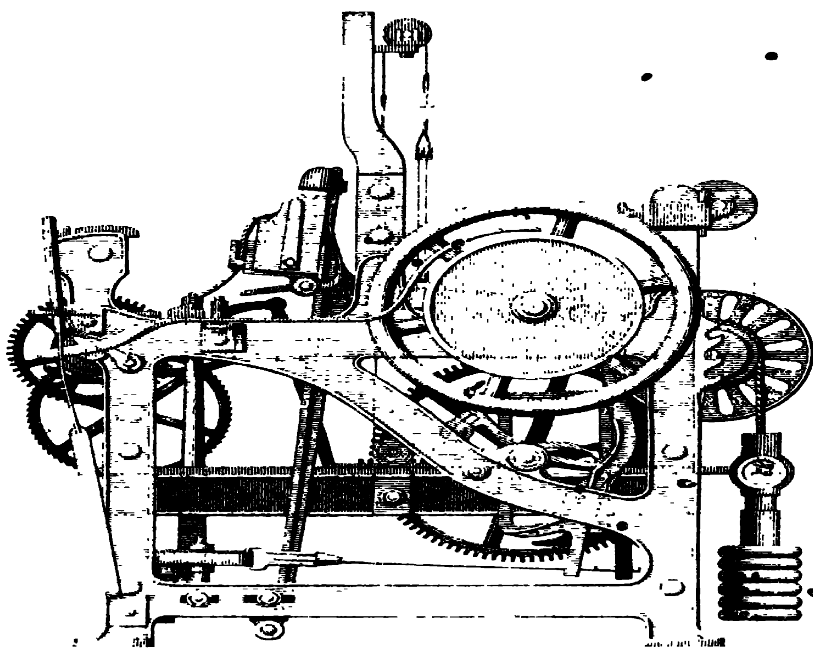
* Encyclopædia Britannica, "Cotton Manufacture."

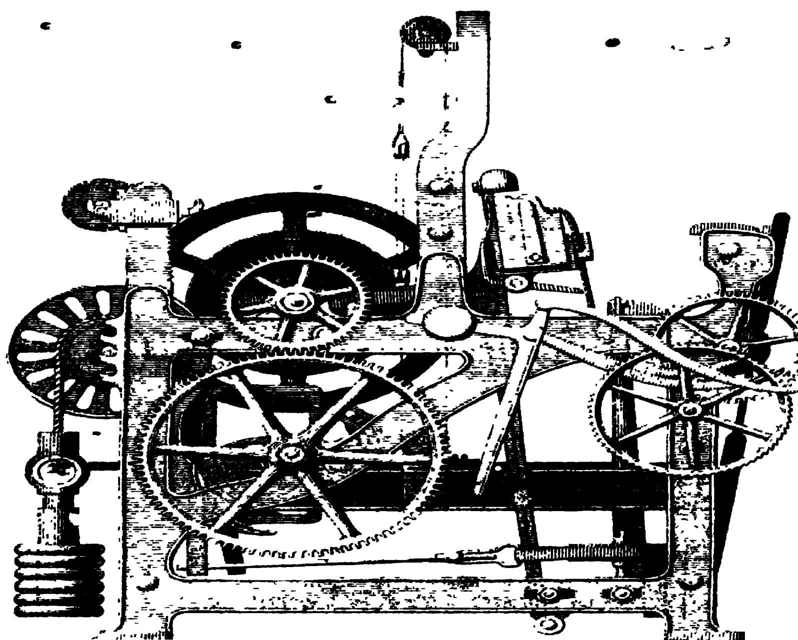
† The consumption of flour in the cotton manufacture is estimated at not less than 42,301,584 lbs. a year, or 215,824 barrels (of 196 lbs.) or 176,256 loads (of 240 lbs. each.)—*Burn's Commercial Glance for* 1832. Bengal flour, an article lately introduced into this country, is found to answer well for dressing.

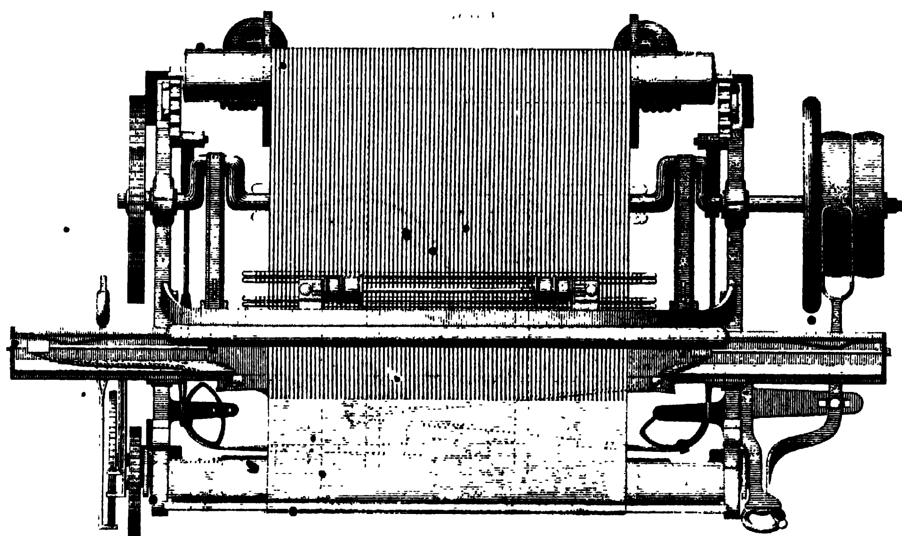
tion of yarn, as in his private undertakings. His book, entitled, "Origin of the new System of Manufacture, commonly entitled 'Power-Loom Weaving,' and the purposes for which this system was invented and brought into use, fully explained in a Narrative, containing WILLIAM RADCLIFFE'S Struggles through Life, to remove the Cause which has brought this Country to its present crisis; written by himself—1828;" displays a mind naturally shrewd and bold, but invincibly obstinate and contracted.

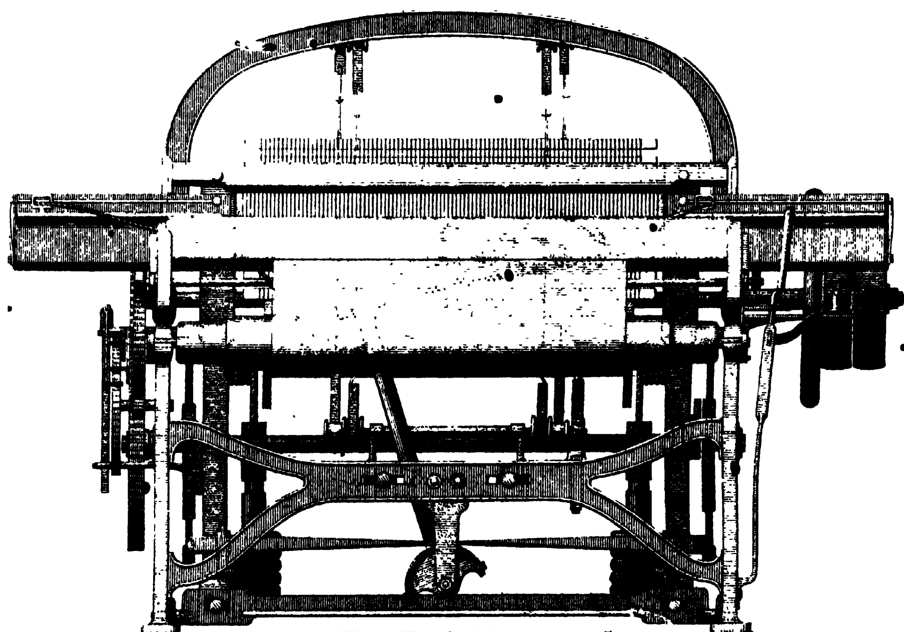
The dressing-machine itself has now in some establishments been superseded, and the warp is dressed in a shorter and simpler way by an improved sizing apparatus.

By the aid of Johnson and Radcliffe's invention, the power-loom became available. A patent for another power-loom was taken out in 1803, by Mr. H. Horrocks, cotton manufacturer, of Stockport, which he further improved, and took out subsequent patents in 1805 and 1813. One of the principal improvements in this loom, the mode of taking up the cloth, Radcliffe states to have been copied from his hand-loom, and to have been the invention of Thomas Johnson. Mr. Peter Marsland, of Stockport, an enterprising spinner, took out a patent for a power-loom, with a double crank, in 1806; but from its complexity, it was not adopted by any one but himself. Superior cloth, however, was made by it. Horrocks's loom is the one which has now come into general use: it is constructed entirely of iron, and is a neat, compact, and simple machine, moving with great rapidity, and occupying so little space, that several hundreds may be worked in a single room of a large









factory.* Horrocks, sharing the common destiny of inventors, failed, and sunk into poverty. This retarded the adoption of the machine; but, independently of this, the power-loom and dressing-machine came very slowly into favour. In 1813, there were not more than one hundred of the latter machines, and 2400 of the former in use. Yet this was enough to alarm the hand-loom weavers, who, attributing to machinery the distress caused by the Orders in Council and the American war, made riotous opposition to all new machines, and broke the power-looms set up at West Houghton, Middleton, and other places. Nevertheless, the great value of the power-loom having now been proved, it was adopted by many manufacturers, both in England and Scotland; and it will, no doubt, in time supersede the hand-loom. The rapidity with which the power-loom is coming into use is proved by the following table, the particulars of which were stated by R. A. Slaney, Esq., M.P., in the house of commons, on the 13th of May, 1830, and which rest on the authority of Mr. Kennedy:—

Number of Power-Looms in England and Scotland.

	In 1820.	In 1829
In England . . .	12,150	45,500
In Scotland . . .	2,000	10,000
Total . .	14,150	55,500

* The plates, containing four views of the power-loom, are from drawings kindly furnished me by Messrs Sharp, Roberts, and Co., machine-makers, Manchester, and shew the loom in its most improved state, as manufactured by them, for plain work, but there are scarcely two establishments in which looms are fitted up alike in all their parts; for, as there is a great variety of modes of

This number would appear to have been somewhat under-rated. Dr. Cleland states, that in 1828, the Glasgow manufacturers had in operation, in that city and elsewhere, 10,783 steam-looms, and 2,060 more in preparation; total 12,843: he supposes there was an increase of 10 per cent. between 1828 and 1832, which would make the number 14,127 in the latter year. This is independent of other parts of Scotland, unconnected with Glasgow. In 1833 evidence was given before the Commons' Committee on Manufactures, Commerce, &c. that "in the whole of Scotland there were 14,970 steam-looms." We may, therefore, safely take the number of power-looms in Scotland at the present time at 15,000.

In England the great increase took place during the years of speculation, 1824 and 1825; and comparatively few power-loom mills were built betwixt that time and 1832. But in 1832, 1833, and the former part of 1834, the trade has been rapidly extending; many mills have been built, and many spinners have added power-loom factories to their spinning mills.* Mr. Kennedy's estimate in 1829 was probably too low for England as well as for Scotland. At all events there are good reasons for believing that there must now be 85,000

effecting each or all of the different movements, particularly that for throwing the shuttle, the combinations are constantly varied, according to the judgment or caprice of masters or managers. The power-loom is also seen in operation in the view of "Power-Loom Weaving," taken by Mr. Allom, from one of the rooms in the large mill of Messrs. Swainson, Birley, & Co., near Preston.

* Mr. Wm. R. Greg, an extensive spinner and manufacturer at Bury, gave evidence before the Select Committee of the House of Commons, on Manufactures, Commerce, and Shipping, (7th August, 1833,) that "the number of power-looms had very materially increased of late years in and about Bury," and also at Stockport, Bolton, Ashton, and in Cheshire. He stated that he did not know any person who was now building a spinning mill without addition of a power-loom mill, (Report, p. 677.)

power-looms in England. This conclusion is deduced from a computation of the number of workmen employed in power-loom weaving, founded on actual returns obtained by the factory commissioners from the cotton mills in Lancashire and Cheshire. The particulars of the estimate will be given in a future chapter, and it will be seen that the estimate has been made in a spirit the reverse of exaggeration. It is also supported by the calculations of Mr. Bannatyne, and Messrs. Samuel Greg and Co., the spinners and manufacturers, of Bury. At the present time, the machine-makers of Lancashire are making power-looms with the greatest rapidity, and they cannot be made sufficiently fast to meet the demands of the manufacturers. The result we have arrived at is as follows:—

Estimated Number of Power Looms in Great Britain, in 1833.

In England	85,000
In Scotland	15,000
Total	100,000

While the number of power-looms has been multiplying so fast, the hand-looms employed in the cotton manufacture are believed not to have diminished between 1820 and 1834, but rather to have increased. In the former year they were estimated by Mr. Kennedy at 240,000. In 1833, Mr. James Grimshaw, a spinner and manufacturer, of Colne, gave his opinion, before the Committee of the Commons, on Manufactures, &c., that the number of hand-loom cotton weavers in the kingdom was about 250,000, (p. 608); whilst Mr. George Smith, manufacturer, of Manchester, estimated

them at only 200,000. (p. 566.) In the present year (1834) several intelligent workmen and manufacturers from Glasgow gave evidence to the Commons' Committee "on Hand-Loom Weavers," that there were 45,000 or 50,000 hand-loom cotton weavers in Scotland alone.* As the workmen had good means of obtaining information, from their associations and clubs, this statement seems worthy of credit; and it is supported by the evidence before the Committee on Manufactures, &c.† But if so, the number of weavers in England must amount to at least 200,000. It is generally estimated that the Scotch manufacture employs about one-seventh as many hands as the English; the quantity of yarn spun in Scotland is only one-ninth or one-tenth of that spun in England; but some of the English yarn is sent to Glasgow, Paisley, &c. to be woven, and the number of weavers in Scotland is undoubtedly greater, in proportion to the spinners, than in England. If, however, we allow the English hand-loom weavers to be only four times as numerous as the Scotch, this must be considered a moderate estimate; and this will justify me in agreeing in opinion with Mr. Grimshaw, that the number of hand-loom weavers in the cotton manufacture in Great Britain must be at least 250,000. Though the whole number of hand-loom weavers has probably rather increased than diminished of late years, from the training up of children to the occupation of their fathers, as well as from the influx of new hands to an employment so easily learnt, yet there are not a few places in Lancashire and Cheshire, where the hand-loom cotton-weavers have turned to the

* See Report; the evidence of William Buchanan, Thos. Davidson, Esq. and Hugh Mackenzie.

† See Report on Manufactures, &c. (1833,) p. 698.



weaving of silk, as at Leigh, Middleton, &c.; or have found employment in the power-loom and spinning factories, as at Stayley-bridge, Hyde, Oldham, Bury, Macclesfield, &c.; and it is earnestly to be desired that the whole number should be thus transferred to other branches of industry, as they have no prospect from continuing to toil at the hand-loom, but increasing misery and degradation.

The power-loom has hitherto been principally employed in weaving cotton goods, and particularly calicoes and fustians; for, although this machine has for more than ten years been well adapted for weaving all kinds of plain silk, linen, woollen, and worsted goods, and all patterns of those fabrics not requiring more than twelve heddles and twelve sheds, and in some patterns upwards of thirty sheds, and of working with one or two shuttles, yet it is comparatively little used in any of those manufactures.

The advantages of the steam-loom and dressing-frame have been thus stated:—Before the invention of the dressing-frame, one weaver was required to each steam-loom; at present a boy or girl, fourteen or fifteen years of age, can manage two steam-looms, and with their help can weave three and a half times as much cloth as the best hand-weaver. The best hand-weavers seldom produce a piece of uniform evenness; indeed, it is next to impossible for them to do so, because a weaker or stronger blow with the lathe immediately alters the thickness of the cloth; and after an interruption of some hours, the most experienced weaver finds it difficult to recommence with a blow of precisely the same force as the one with which he left off. In steam-looms the lathe gives a steady, certain blow, and, when once regu-

lated by the engineer, moves with the greatest precision from the beginning to the end of the piece. Cloth made by these looms, when seen by those manufacturers who employ hand-weavers, at once excites admiration, and a consciousness that their own workmen cannot equal it."*

Since this statement was published (in 1823,) the power-loom has been further improved, or at least its motion has been accelerated, so that the comparison between the hand-loom weaver and the power-loom weaver will now be still more to the disadvantage of the former. The following is furnished by a manufacturer, as a correct statement of the advance which has been made:—

"A very good *hand weaver*, 25 or 30 years of age, will weave *two* pieces of 9-8ths shirtings per week, each 24 yards long, containing 100 shoots of weft in an inch; the reed of the cloth being a 44 Bolton count, and the warp and weft 40 hanks to the lb.

"In 1823, a *steam-loom weaver*, about 15 years of age, attending two looms, could weave *seven* similar pieces in a week.

"In 1826, a steam-loom weaver, about 15 years of age, attending to two looms, could weave *twelve* similar pieces in a week; some could weave fifteen pieces.

"In 1833, a steam-loom weaver, from 15 to 20 years of age, assisted by a girl about 12 years of age, attending to four looms, can weave *eighteen* similar pieces in a week; some can weave twenty pieces."

A machine for making cards has within a few years been introduced from America, and made the subject of a patent by Mr. Dyer, of Manchester, the patentee of the tube-frame. The process is remarkably beautiful and rapid. The wire which is to form the teeth of the card is drawn from a reel by the machine, a sufficient portion

* Guest's History of the Cotton Manufacture, p. 46.

cut off to make a pair of teeth, and that portion bent so as to form two teeth projecting in the same direction; the sheet of leather, which is also moved along at a certain rate, has two holes drilled in it, to receive the teeth; the teeth of wire are immediately inserted, and bent downwards at the proper angle, and thus the operation is completed, not requiring more time for all the processes than a tailor requires for each stitch taken by his needle, and the whole is performed by machinery without the intervention of human hands. The advantage of this machine is in making cards cheaper than those made by hand: the cards are said not to be better, if so good.

Before quitting the subject of the machines used in the cotton manufacture, it will be proper briefly to mention three machines used in the early stages, previous to the process of carding. When the cotton wool comes to England, from the very great pressure to which it has been subjected in packing, it is in hard matted lumps; and it also contains seeds and dirt. It is, therefore, put into a machine, called the *willow*, which, by its revolving spikes, tears open the cotton, and, by the blast of a powerful fan, frees it from most of its dirt and seeds. It is then taken to the *scutching machine*,—a most useful machine, for more completely opening and cleaning the cotton, invented by Mr. Snodgrass, of Glasgow, in 1797, and introduced into Manchester about 1808 or 1809 by Mr. James Kennedy; in which the cotton is subjected to be beaten by metallic blades revolving on an axis at the speed of from 4000 to 7000 revolutions in a minute, so that all the fibres are opened, and the seeds and dirt fall down through a frame of wire-work. Before the invention of

this machine, the cotton was opened and cleaned by being placed upon cords stretched on a wooden frame, and then beaten by women with smooth switches,—an occupation very fatiguing, and which required twenty times as much labour as the new process,* but which is nevertheless still used to clean the finest cotton. The third machine is the *spreading* or *lapping machine*, which was constructed and brought into use by Mr. Arkwright (the son of Sir Richard) and Mr. Strutt, in Derbyshire, and the effect of which is to spread a given weight of cotton equally over a given surface, and to roll it up on a roller, so as to be in a proper state to be conveyed to the carding machine.

Let us briefly review the different processes through which the cotton goes, in its conversion into cloth, all of which are performed in many of the large spinning and weaving mills. The cotton is brought to the mill in bags, just as it is received from America, Egypt, or India; and is then stowed in warehouses, being arranged according to the countries from which it may have come. It is passed through the *willow*, the *scutching-machine*, and the *spreading-machine*, in order to be opened, cleaned, and evenly spread. By the *carding-engine* the fibres are combed out and laid parallel to each other, and the fleece is compressed into a sliver. The sliver is repeatedly drawn and doubled in the *drawing-frame*, more perfectly to straighten the fibres, and to equalize the grist. The *roving-frame*, by rollers and spindles, produces a coarse and loose thread; which the *mule* or *throstle* spins into yarn. To make the warp, the twist is transferred from cops to bobbins by the *winding-machine*, and from the bobbins at the *warping-mill* to a

* Mr. Kennedy—"Rise and Progress of the Cotton Trade."

cylindrical beam. This beam being taken to the *dressing-machine*, the warp is sized, dressed, and wound upon the weaving beam. The latter is then placed in the *power-loom*, by which machine, the shuttle being provided with cops of weft, the cloth is woven.

Such, without entering too much into minutiæ, are the processes by which the vegetable wool is converted into a woven fabric of great beauty and delicacy; and it will be perceived that the operations are numerous, and every one of them is performed by machinery, without the help of human hands, except merely in transferring the material from one machine to another. It is by iron fingers, teeth, and wheels, moving with exhaustless energy and devouring speed, that the cotton is opened, cleaned, spread, carded, drawn, roved, spun, wound, warped, dressed, and woven. The various machines are proportioned to each other in regard to their capability of work, and they are so placed in the mill as to allow the material to be carried from stage to stage with the least possible loss of time. All are moving at once—the operations chasing each other; and all derive their motion from the mighty engine, which, firmly seated in the lower part of the building, and constantly fed with water and fuel, toils through the day with the strength of perhaps a hundred horses. Men, in the mean while, have merely to attend on this wonderful series of mechanism, to supply it with work, to oil its joints, and to check its slight and infrequent irregularities;—each workman performing, or rather superintending, as much work as could have been done by *two or three hundred men* sixty years ago.* At the

* Mr. Kennedy stated, in 1815, since which time many improvements have been made, that "the united effects of the spinning machines amounted to thi-

approach of darkness the building is illuminated by jets of flame, whose brilliance mimics the light of day,—the produce of an invisible vapour, generated on the spot. When it is remembered that all these inventions have been made within the last seventy years, it must be acknowledged that the cotton mill presents the most striking example of the dominion obtained by human science over the powers of nature, of which modern times can boast. That this vast aggregate of important discoveries and inventions should, with scarcely an exception, have proceeded from English genius, must be a reflection highly satisfactory to every Englishman.

that the labour of one person, aided by them, can now produce as much yarn, in a given time, as 200 could have produced fifty years ago."—*Rise and Progress of the Cotton Trade.* Mr. Farey, in his "*Treatise on the Steam-Engine,*" says—"An extensive cotton mill is a striking instance of the application of the greatest powers to perform a prodigious quantity of light and easy work. A steam engine of 100 horse-power, which has the strength of 880 men, gives a rapid motion to 50,000 spindles, for spinning fine cotton threads: each spindle forms a separate thread, and the whole number work together in an immense building, erected on purpose, and so adapted to receive the machines that no room is lost. Seven hundred and fifty people are sufficient to attend all the operations of such a cotton mill; and by the assistance of the steam-engine they will be enabled to spin as much thread as 200,000 persons could do without machinery, or one person can do as much as 266. The engine itself only requires two men to attend it, and supply it with fuel. Each spindle in a mill will produce between two and a half and three hanks (of 840 yards each) per day, which is upwards of a mile and a quarter of thread in twelve hours; so that the 50,000 spindles will produce 62,500 miles of thread every day of twelve hours, which is more than a sufficient length to go two and a half times round the globe."

CHAPTER XII.

BLEACHING AND CALICO PRINTING.

Ancient modes of BLEACHING.—Improvement suggested by Dr. Home.—Grand improvement in the application of *chlorine* (oxymuriatic acid,) discovered by Scheele, and applied to bleaching by Berthollet.—Introduced into England by James Watt, and into Lancashire by Thomas Henry.—Improvements by Mr. Tennant, of Glasgow.—The processes of bleaching described.—Extent and admirable management of bleach works.—CALICO PRINTING.—First practised by the Indians.—Cotton and linen more difficult to dye than woollen and silk; their chemical composition.—Pliny's description of calico printing in Egypt.—Oriental modes of calico printing.—Introduction of the art into Europe and England.—Excise duties early laid on printed goods.—The printing of calicoes prohibited.—Legislation on the subject.—Calico printing first practised in Lancashire about 1764.—Greatly extended and improved by Mr. Robert Peel, and his son, Sir Robert Peel: notice of the Peels of Church, and the Peels of Bury.—Block printing.—Important invention of cylinder printing.—Mechanical engraving invented in Manchester.—Etching of cylinders by a remarkable apparatus.—Manchester celebrated for its engraving.—Improvement in the construction of blocks.—Surface printing by engraved wooden rollers.—Union or mule machine.—Chemical improvements in calico printing.—Use of mordants.—Discharge work.—Resist work.—Dyeing of cloth Turkey red, and discharging the pattern.—Bronze style.—Legislative interference with the printing business.—New duties in 1784: repealed in 1785: duties fixed in 1785 and 1787.—Repeal of the duties on printed goods in 1831: its beneficial effects.—Tables of calicoes and muslins printed in Great Britain.—Statistical view of the extent of the printing business.—Extent and beauty of the print works in Lancashire.

AFTER the manufacture of the cloth is complete, there is the important process of bleaching to be undergone by all cotton goods; and the further process of printing, by such muslins and cottons as are intended for outer garments, or for furniture. These are two very exten-

sive branches of the business: the former is necessary to remove the dirt and grease contracted in the manufacture, and the dressing applied to the warp, and also to destroy all the colour belonging to the raw material, so as to make the cloth perfectly white; and the latter very greatly adds to the beauty and value of the cloth, by the variety of patterns and colours impressed upon it, from the ordinary stripe or check of a furniture print, to the rich, elegant, and variegated patterns, which render these manufactures suitable for the dress of ladies of the highest rank. Chemical science has done at least as much to facilitate and perfect these processes, as mechanical science to facilitate and perfect the operations of manufacturing.

The bleaching process, as performed in the middle of the last century, occupied from six to eight months. "It consisted in steeping the cloth in alkaline leys for several days, washing it clean, and spreading it upon the grass for some weeks. The steeping in alkaline leys, called *bucking*, and the bleaching on the grass, called *crofting*, were repeated alternately for five or six times. The cloth was then steeped for some days in sour milk, washed clean, and crofted. These processes were repeated, diminishing every time the strength of the alkaline ley, till the linen had acquired the requisite whiteness."*

The art of bleaching was at that time so little understood in Great Britain, that nearly all the linens manufactured in Scotland were sent to Holland to bleach, and were kept there more than half a year, undergoing, in the bleach-fields around Haarlem, the tedious processes just described. The mode of bleach-

* Encyclopædia Britannica, art. "Bleaching."

ing, like that of manufacturing, was no doubt brought from the East, where it has been practised immemorially. In some parts of India, as will be seen from the testimony of Tavernier, quoted at p. 57, the acid of lemons, that is, citric acid, in a very diluted state, was used instead of the acid of sour milk; and the muslins and other cotton goods of Bengal were conveyed to the opposite coast of India to be bleached, on account of "the large meadows and plenty of lemons" near Baroche and Raioxsary. In other parts, buffaloes' milk is still used.

The first considerable improvement in bleaching in Great Britain, consisted in the substitution of a more powerful acid for sour milk. Dr. Home, of Edinburgh, about the middle of the last century, introduced the practice of employing water acidulated with sulphuric acid; by the quicker operation of this liquid, the souring of the cloth was effected in a few hours, whereas it formerly occupied days and weeks; and as the souring process had under both modes to be repeated, so much time was saved by the use of sulphuric acid as to reduce the whole operation of bleaching from eight months to four.

The grand improvement in bleaching, however, was in the application of *chlorine*, formerly termed *oxymuriatic acid*, to the art. This acid was discovered in 1774, by Scheele, the Swedish philosopher, who observed its property of destroying vegetable colours, from its having bleached the cork of his phial. This observation, having been recorded, suggested to the active mind of the French chemist, Berthollet, the thought of applying the acid to the bleaching of cloths made of vegetable fibres; and, in 1785, having found by experiment that it answered the purpose, he made known this

great discovery, which brings down the time required for bleaching from months to days, or even to hours.

James Watt, who was an accomplished chemist, as well as mechanician, learnt from Berthollet, at Paris, the success of his experiments; and when he returned to England, at the end of 1786, he introduced the practice at the bleach-field of his father-in-law, Mr. Macgregor, near Glasgow, with several improvements of his own, and found it to answer perfectly. A little while after this, and without knowing any thing of Watt's experiments, but acting merely on the suggestions in Berthollet's papers in the *Journal de Physique*, Mr. Thomas Henry, of Manchester, who was at that time delivering lectures on dyeing, printing, and bleaching, began to try experiments in bleaching with oxymuriatic acid. He prosecuted the subject with diligence and success, and made known the result to the Manchester bleachers in 1788, by a public exhibition of the bleaching of half a yard of calico. "In consequence of this exhibition, he was applied to by Mr. Ridgway, of Horwich, near Bolton, to be instructed in the new process. And the instructions which he accordingly received, were the first step of a series of improvements carried on by Mr. Ridgway and his son, with an ability and spirit of enterprise, which have raised their establishment to its present extent and importance." Mr. Henry was also one of the first persons to suggest the addition of lime, which takes away the noxious smell of the oxymuriatic acid, without injuring its bleaching properties.

So great was the facility thus given to the process of bleaching, that it is recorded, that a bleacher in Lancashire received 1400 pieces of grey muslin on a

Tuesday, which, on the Thursday immediately following, were returned bleached to the manufacturers, at the distance of sixteen miles, and they were packed up and sent off on that very day to a foreign market. This is considered as not an extraordinary performance. Without this wonderful saving of time and capital, the quantity of cotton goods now manufactured could scarcely have been bleached.

Scheele and Berthollet had made their oxymuriatic acid from muriatic acid and manganese. Watt used the cheaper materials of common salt, black oxide of manganese, and sulphuric acid; and with the gas produced he impregnated water confined in air-tight vessels of wood lined with pitch. To remove the very noxious and offensive smell of oxymuriatic acid, Mr. Henry, of Manchester, and Mr. Tennant, of Glasgow, each resorted to the use of lime, which deprives the liquid of its smell without impairing its bleaching qualities. Mr. Tennant, "after a great deal of most laborious and acute investigation, hit upon the method of making a saturated liquid of chloride of lime, which was found to answer perfectly all the purposes of the bleacher."* He took out a patent in 1798, but it was set aside in 1802, on the ground that the whole of the process which he described in his patent was not new. Having, however, obtained a second patent in 1799, for impregnating slacked lime in a dry state with chlorine, which patent was not contested, he succeeded in establishing a large manufacture of this article, and in bringing it into extensive use. Mr. Tennant uses 5½ parts of black oxide of manganese, 7½ parts of common salt, and 12¼ parts of sulphuric acid of the specific

* Ency Britannica.

gravity of 1·843, diluted with an equal quantity of water, to make the chlorine gas, with which he impregnates a layer of slacked lime, some inches thick, in a stone chamber. By recent improvements in the manufacture, he has doubled the value of the bleaching powder, whilst its price is reduced to one-half: the present price is three-pence per pound. By many bleachers this powder is used, mixed with a proper quantity of water; but the great bleachers use liquid chloride of lime, which they make in leaden stills, steam being used to expel the gas from the materials, and the gas being received into a cream of lime, which becomes saturated with it.

Cotton is much more easily bleached than linen, owing to the smaller quantity of colouring matter in the former, and to its being less fixed. The processes through which cottons pass in the hands of the bleacher are as follows:—The cloth is first singed, by being drawn rapidly over a copper or iron cylinder heated to a red heat, which burns off the down and loose fibres on the surface, without injuring the fabric. It is next thrown in loose folds into a cistern of cold water, where it remains some time; and it is afterwards more effectually washed by being put into a large hollow wheel, called the dash-wheel, usually divided into four compartments; this is supplied with a jet of clear spring water, thrown in through a circular slit in the side, which revolves opposite the end of a flattened pipe, by which means the cloth is well washed, as it is thrown backwards and forwards in the rapidly-revolving wheel. By this means a considerable portion of the weaver's dressing is removed. Next the cloth is boiled with lime: the pieces of calico are placed in a kier or

boiler, having a false bottom perforated with holes, and with layers of cream of lime betwixt the pieces, 1 lb. of lime being used for every 35 lbs. of the cloth: it is so contrived that the boiling water is spouted upon the goods, filters through them and the lime into that part of the boiler below the false bottom; is again forced up a pipe in the middle of the boiler, and falls again upon the goods; and this process is repeated for about eight hours. By this lime boiling, the dressing, dirt, and grease are completely removed from the cloth; and the lime itself is removed by a careful washing in the dash-wheel.

The cloth is now subjected to the action of the bleaching liquid, that is, chloride of lime dissolved in water. A solution of one pound of bleaching powder with one gallon of water, has a specific gravity of 1·05; but water is added till the solution is reduced to the specific gravity of 1·02. The quantity of this liquor used for 700 lbs. of cloth is 971 gallons; and 388 lbs. of the solid bleaching powder is required for 700 lbs. of cloth. The goods are left in the cold bleaching liquid about six hours, and when taken out they are considerably whitened. Having been washed, the cloth is next put into a very weak solution of sulphuric acid, containing eight gallons of the acid in 200 gallons of water: this is called the *souring* process, which lasts about four hours: by this the oxide of iron, which in the course of the operations has been deposited on the cloth, giving it a yellowish hue, and the lime which it had imbibed, are removed, and the cloth becomes much whiter. It is again washed in cold water, and then boiled for eight hours more in an alkaline ley: 64 lbs. of carbonate of soda are used to 2100 lbs. of the unbleached cloth. After this the cloth is steeped a second

time in the bleaching liquid, which is only two-thirds of the strength of the first, where it remains five or six hours; and a second time in the mixture of sulphuric acid and water, where it remains four hours. The last souring process completes the bleaching of the cloth, which comes out of the acid solution perfectly white.

The cloth is then very carefully washed, to remove all trace of the sulphuric acid: it is freed from the greater part of the water, by being squeezed betwixt two rollers, and is then straightened, and mangled in the damp state. To improve the appearance of the cloth, it is usually passed through starch made of wheaten flour, often mixed with porcelain clay and calcined sulphate of lime; by which the cloth is made stiffer, and appears to have greater substance and strength than it proves to have after being washed; a contrivance originally devised for the purpose of fraud, and which, though now too generally understood to be regarded as fraudulent, it would be creditable to the trade to lay aside. The cloth is dried by being passed through a drying machine, consisting of several copper cylinders heated by steam: it is then again damped, in order to fit it to receive the gloss which is imparted in the process of calendering. The calender consists of several wooden and iron rollers placed above each other in a frame, and held together by levers and pullies; the cloth, passing betwixt these rollers, is strongly pressed; the surface becomes glossy, and sometimes it is made to assume a wiry appearance by two pieces being put through the calender together, in which case the threads of each are impressed on the face of the other. The goods are then folded up in pieces, stamped with marks varying according to the foreign or domestic markets for which they are intended,

and pressed in a Bramah's press; after which they are packed up, and sent to the merchant.*

Such are the processes by which the rough, grey, and dirty fabric brought in by the weaver, is converted into the smooth and snowy cloth ready for the hands of the sempstress. The processes vary a little in duration and frequency, according to the quality of the cloth to be bleached. Every thing is done by machinery or by chemical agents, and the large bleach-works require steam engines of considerable power. Human hands only convey the cloth from process to process. There is much beauty in many of the operations; and great skill is needed in the mere disposition of the several cisterns and machines, so that the goods may pass through the processes with the smallest expenditure of time. Large capital has been expended on many of the bleach-works; an extraordinary perfection has been attained in the machinery, and in all the details of the arrangements; strict method and order prevail; the managers are men of science, who are eager to adopt every chemical and mechanical improvement that may occur to themselves or to others. So greatly has bleaching been cheapened and quickened by the discoveries of modern science, that all the processes above described are ordinarily performed in two or three days, and at the trivial cost of a halfpenny per yard on the cloth bleached and finished. The most extensive bleach-works in Lancashire are those of Mr. Thomas Ridgway, of Horwich, near Bolton.

* The above account of the mode of bleaching is principally abridged from the able and elaborate article on that subject in the new edition of the Encyclopædia Britannica,—confirmed, however, by personal observation, and by the works of Berthollet and others.

We come now to treat of the important and beautiful art of *calico printing*, which constitutes a very large branch of the cotton manufacture, and by means of which the value of calicoes, muslins, and other cotton fabrics, is greatly enhanced. Cotton cloth, when used for under garments, is generally worn in the white state; but when used for the outer garments of the female sex, the drapery of beds and windows, the coverings of furniture, and similar purposes, it is ornamented with colours and patterns. Unlike silk and woollen fabrics, cottons are very rarely dyed of a uniform colour throughout; a variety of colours is fixed upon a single piece, and they are printed on the white cotton or muslin in an endless variety of patterns, thus giving a light and elegant effect to the print. The art of the calico printer, therefore, not only comprehends that of the *dyer*, which requires all the aid of chemical science, but also that of the *artist*, for the designing of tasteful and elegant patterns, that of the *engraver*, for transferring those patterns to the metal used to impress them on the cloth, and that of the *mechanician*, for the various mechanical processes of engraving and printing. *Taste*, *chemistry*, and *mechanics* have been called the three legs of calico printing.

To do justice to all the branches of this extensive subject would require volumes, rather than a single chapter, and would demand an author well skilled in several distinct sciences. A brief and popular description is all that the limits of this work will admit.

The Indians were not only the first manufacturers, but also, in all probability, the first who printed or stained cottons. Pliny mentions, that *dyed linen* (which

was no doubt dyed cotton *) was first seen by the Greeks in Alexander's wars with the Indians. Before this time, Herodotus (book i. c. 203) had mentioned a nation on the borders of the Caspian, who painted figures of animals on their garments with a vegetable dye. He says—"They have trees whose leaves possess a most singular property: they beat them to powder, and then steep them in water: this forms a dye, with which they paint on their garments figures of animals. The impression is so very strong that it cannot be washed out; it appears to be interwoven in the cloth, and wears as long as the garment." He does not, however, state the material of which the garments were made. Strabo, and the author of the Periplus, as has already been seen, (pp. 19 and 23,) celebrate the beautiful flowered cottons of India, and the brilliant and various dyes of that country. And from the very early civilization of the Indians, and their stationary condition for several thousand years, it may be inferred that calico printing existed amongst them many ages before the time of Alexander. From the books of Moses, it is evident that the Egyptians practised the art of dyeing, in blue, purple, and scarlet, 1500 years B. C.; and the Tyrians were, from a very early date, famous for dyeing the finest purple.

Woollen and silk, which are animal substances, are dyed much more easily than cotton and linen, which are vegetable substances. Chemists have not yet ascertained upon what the difference between animal and vegetable bodies, in their capacity of receiving colours, depends. It appears from analysis that wool and silk

* See pp. 18, 19.

contain an appreciable quantity of azote, which is not found in either cotton or flax, and this is the only chemical difference that has been discovered in their composition, except as to the proportions of the other constituents: but this does not enable chemists to understand why the animal substances should receive colours so much more easily than the vegetable substances. The following are the results of Dr. Ure's analytical experiments on the four principal subjects of dyeing, as stated in his translation of Berthollet's "Elements of the Art of Dyeing:"—

	Carbon.	Hydrogen.	Oxygen.	Azote.
Wool . . .	53·70	2·80	31·20	12·30
Silk . . .	50·69	3·94	34·04	11·33
Cotton . .	42·11	5·06	52·83	——
Flax . . .	42·81	5·50	51.70	——

In the time of Pliny, the Egyptians practised the art of dyeing or staining their cloths in various colours, by the use of mordants; and there is no doubt that these cloths were cotton and linen. He thus distinctly describes the process:—"Garments," he says, "are painted in Egypt in a wonderful manner, the white cloths being first smeared, not with colours, but with drugs which absorb colour. These applications do not appear upon the cloths, but when the cloths are immersed in a cauldron of hot dyeing liquor, they are taken out the moment after painted. It is wonderful that, although the dyeing liquor is only of one colour, the garment is dyed by it of several colours, according to the different properties of the drugs which had been applied to different parts. Nor can this dye be washed out. Thus the vat, which would doubtless have confused all the colours if the cloths had been immersed in a painted state, produces a

diversity of colours out of one, and at the same time fixes them immoveably."*

From this passage it is evident that an art analogous to calico-printing was practised by the ancients, if not on scientific principles, yet in a manner which indicated considerable proficiency in the art, the result of long practice and close observation. When the Portuguese visited India, on the discovery of the passage by the Cape of Good Hope, they found that the natives stained their cottons in the manner described by Pliny, and it is probable that they have done so from a remote antiquity. Yet the Indians have no scientific knowledge of chemistry, and many of their processes are so rude, inconvenient, and encumbered with useless parts, that they were rejected by the people of Europe soon after calico printing began to be practised here, though it was begun and carried on for a considerable time with very little aid from chemical science.† In different parts of the East, great varieties prevail in the knowledge and skill with which this art is practised. In some parts block printing is wholly unknown, and in India the patterns are usually, if not always, drawn with a pencil or reed,‡ as may be inferred from the fact that no two forms or figures in the work are exactly alike: but at Orfah, in Mesopotamia, the printers are described by Mr. Buckingham as having small wooden

* Pingunt et vestes in Ægypto inter pauca mirabili genere, candida vela postquam attrivere illinentes non coloribus, sed colorem sorbentibus medicamentis. Hoc cum fecêre, non apparet in velis: sed in cortinam pigmenti ferventis mersa, post momentum extrahuntur picta. Mirumque cum sit unus in cortina color, ex illo alius atque alius fit in veste, accipientis medicamenti qualitate mutatus. Nec postea ablui potest: ita cortina non dubie confusura colores, si pictos acciperet, digerit ex uno, pingitque dum coquit."—Plinii Hist. Nat. lib. xxxv. cap. 11.

† Bancroft on the Philosophy of Permanent Colours, vol. i. p. lx. Introd.

‡ Ibid, vol. i. pp. 352, 355.

blocks, of four to six square inches, and using them nearly in the same way as the block printers in this country, but being of course ignorant of the great improvement of cylinder printing.* The Chinese practised block printing before any species of printing was known in Europe. Calico printing is practised in Asia Minor, Turkey, and indeed in all the countries of the East, by such means and processes as prove clearly the Eastern origin of the art. The processes of calico printing in India are described in certain letters written by Father Cœurdoux, a missionary at Pondicherry, published in Vol. 26 of "Recueil des Lettres Edifiantes et Curieuses;" from which Dr. Bancroft has drawn up his account in his "Philosophy of Permanent Colours."†

Calico printing is believed not to have been practised in Europe till the seventeenth century. In what country the art was first introduced is doubtful. At the beginning of the eighteenth century Augsburg, where the manufacture of cotton had prevailed long before its introduction into England, was famous for its printed linens and cottons; but even on the spot it is not easy to obtain any authentic information of its introduction. That city long supplied the manufacturers of Alsace and Switzerland with colour makers, dyers, &c.—a proof of the earlier establishment of the art in Augsburg, which has witnessed alike its birth and decay.

It is mentioned by Anderson, that calico printing commenced in London in 1676.‡ Mr. James Thomson, a scientific and accomplished calico printer at Primrose,

* Buckingham's Travels in Mesopotamia, vol. i. chap. v. p. 145, 146.

† Vol. i. p. 350.

‡ Anderson's History of Commerce, vol. ii. p. 159.

near Clitheroe, in his evidence before a select committee of the house of commons on trade, manufactures, and shipping, in 1833, informed the committee that "the origin of printing in England dated from about the year 1690, when a small print-ground was established on the banks of the Thames, at Richmond, by a Frenchman, who in all probability was a refugee after the revocation of the edict of Nantz. The first large establishment was at Bromley-hall, in Essex: it stood No. 1 in the Excise books when the duty was first imposed, shewing that it was at that time the most considerable manufactory of printed calicoes near London."

Calico printing could not for a long time have succeeded in England, if parliament had not prohibited the introduction of the cheap and beautiful prints of India, Persia, and China, which was done in 1700, by the Act 11 and 12 William III. c. x. This Act was intended to protect the English woollen and silk manufactures from the competition of Indian goods, but it also had the effect of stimulating and greatly increasing the infant trade of printing: for the English had then become accustomed to the use of printed calicoes and chintzes,* and the taste for these articles could only be gratified, after the prohibition of the Indian prints, by printing in this country the plain Indian calicoes, which were still admitted under a duty. In 1712 the printing business had become sufficiently extensive to lead parliament to impose an excise duty of 3d. per square yard on calicoes printed, stained, painted, or dyed (10 Anne, c. 19); and in 1714 the duty was raised to 6d. per square yard, (12 Anne, sec. 2. c. 9.) Half these duties were laid by the same statutes on printed linens. It would seem

* See p. 77.

that the Act of 1700 had become of little effect, probably in part through the extravagant severity of the penalty it imposed on the buyer or seller of Indian prints, viz. £200; but still more from the improvement and extension of printing in this country, by which means Indian goods were still largely consumed, to the detriment, as was imagined, of the English woollen and silk manufactures. Parliament therefore passed a law in 1720, (7 George I. c. 7,) prohibiting the use or wear of any printed or dyed calicoes whatsoever, whether printed at home or abroad, and even of any printed goods in which cotton formed a part; excepting only calicoes dyed all blue, and muslins, neckcloths, and fustians.* The effect of this law was to put an end to the printing of calicoes in England, and to confine the printers to the printing of linens. In 1736, (by the 9th George II. c. 4,) so much of the Act of 1720 was repealed as forbad the use or wear of printed goods of a mixed kind containing cotton; and thenceforth cloths were made and printed of linen warp and cotton weft, probably approaching in appearance to calicoes.

The printing trade is thus mentioned in a work entitled, "A Plan of the English Commerce," published in 1728:—

"I proceed to another visible increase of trade, which spreads daily among us, and affects not England only, but Scotland and Ireland also, though the consumption depends wholly upon England, and that is, the printing or painting of linen. The late Acts prohibiting the use and wearing of painted callicoes either in

* The French government pursued the same policy as the English, and, in order to favour the silk manufacture, prohibited, under severe penalties, the wearing of chintzes, and printed linens and cottons. These prohibitions were not annulled till 1759.—*Bancroft*, vol. i. p. lviii.

clothes, equipages, or house furniture, were without question aimed at improving the consumption of our woollen manufacture, and in part it had an effect that way. But the humour of the people running another way, and being used to and pleased with the light, easie, and gay dress of the callicoes, the callicoe printers fell to work to imitate those callicoes by making the same stamps and impressions, and with the same beauty of colours, upon linen, and thus they fell upon the two particular branches of linen called Scots cloth and Irish linen. So that this is an article wholly new in trade, and indeed the printing itself is wholly new; for it is but a few years ago since no such thing as painting or printing of linen or callicoe was known in England; all being supplied so cheap and performed so very fine in India, that nothing but a prohibition of the foreign printed callicoes could raise it up to a manufacture at home; whereas now it is so increased, that the parliament has thought it of magnitude sufficient to lay a tax upon it, and a considerable revenue is raised by it." p. 296.

Printed linens and mixed goods having in some degree supplied the place of printed calicoes, the business continued to extend, though much more slowly than it would have done if the printing of calicoes had been permitted. About the year 1750 it was computed that fifty thousand pieces of linen and cotton goods were annually printed in Great Britain, and chiefly in the neighbourhood of London.* The cloth was principally of the kind called *Blackburn-greys*, being woven at Blackburn, of linen warp and cotton weft. In 1754 it would appear that the art had attained considerable excellence, as the following notice appears in the *Gentleman's Magazine* for March in that year:—

" Mr. Sedgwick, a very considerable wholesale trader in printed goods, had the honour to present her royal highness the Princess of Wales with a piece of English chintz, of excellent workmanship,

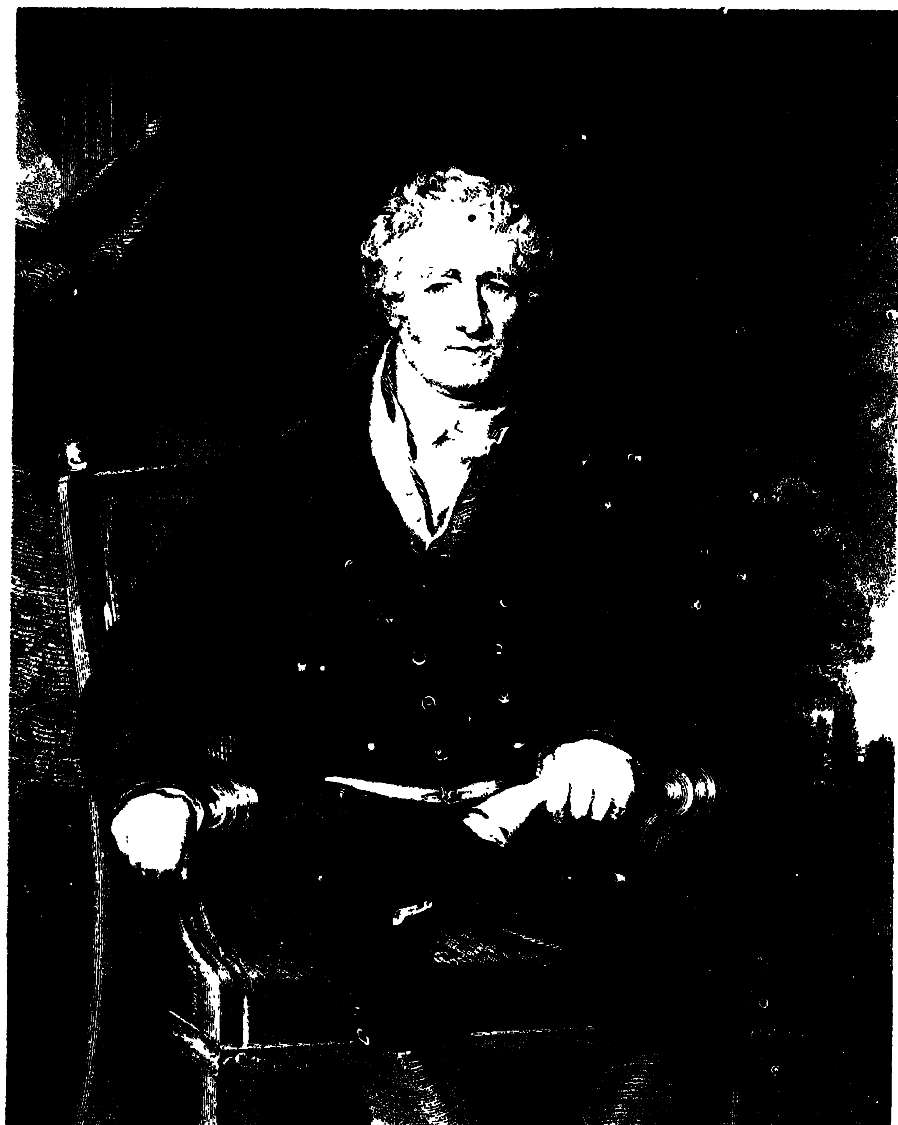
* Bancroft, vol. i. p. lviii.

printed on a British cotton,* which, being of our own manufacture, her royal highness was most graciously pleased to accept of. And on Sunday morning the said gentleman was, by Sir Wm. Irby, introduced to her royal highness at Leicester-house, and had the honour to kiss her hand; when her highness was pleased to say she was very glad we had arrived at so great a perfection in the art of printing, and that in her opinion it was preferable to any Indian chintz whatsoever, and would give orders to have it made up into a garment for her highness's own wear, immediately, as an encouragement to the labour and ingenuity of this country."

The printing business was carried on almost exclusively in the neighbourhood of London till after the middle of the eighteenth century, since which time it has gradually declined there, yielding to the disadvantages of its local situation, to its remoteness from the great seat of the cotton manufacture in the north, to high wages, dear fuel, and, above all, to the superior activity and science of the calico printers of Lancashire;—experiencing in this respect the fate of the printing establishments near Paris, which have been eclipsed by the industry and talent of Alsace. The printing of silk, especially handkerchiefs, both of Indian and British manufacture, now gives employment to many of the workmen and factories round London, heretofore employed on calicoes and muslins.

The introduction of calico printing into Lancashire is ascribed to the Messrs. Clayton, of Bamber Bridge, near Preston, who began the business on a small scale as early as the year 1764. They were followed, and with greater vigour, by Mr. Robert Peel, the grandfather of the present right honourable sir Robert Peel, bart., late secretary of state. Mr. Peel was originally a yeoman farming his own estate, and lived at Cross,

* This must have been a fabric of cotton and linen mixed.



Goethe

afterwards called Peel-fold, near Blackburn. Being of an active and enterprising disposition, he began the manufacture of cotton, and he is mentioned as one of the first persons who tried the carding cylinder. He also took up the printing business, and I have been informed by a member of his family that he made his first experiments secretly in his own house; that the cloth, instead of being calendered, was ironed by a female of the family; and that the pattern was a parsley leaf. Stimulated by the success of his experiments, he embarked in the printing business with small means and convenience, and shortly after removed to Brookside, a village two miles from Blackburn. Here he carried on the business for some years with the aid of his sons; and by great application, skill, and enterprise, the concern was made eminently prosperous. His eldest son, Robert, afterwards created a baronet, possessed strong talents, which he devoted assiduously to business from an early age, and thus contributed much to the success of the printing, spinning, and manufacturing businesses; and in each of these branches the Peels soon took a lead in Lancashire. They eagerly adopted every improvement suggested by others, and many improvements originated in their own extensive establishments. As the elder Mr. Peel had several sons, Robert quitted his father's concern about 1773, and established himself with his uncle, Mr. Haworth, and his future father-in-law, Mr. William Yates, at Bury, where the cotton spinning and printing trades were carried on for many years with pre-eminent success, and on a most extensive scale, and are, indeed, continued, though in other hands, to the present day. Mr. Peel, the father, with his other sons, and another

Mr. Yates, established the print-works at Church, and had also large works at Burnley, Salley Abbey, and Foxhill-bank, and spinning mills at Altham, and afterwards at Burton-upon-Trent, in Staffordshire. So widely did these concerns branch out, and so liberally and skilfully were they conducted, that they not only brought immense wealth to the proprietors, but set an example to the whole of the cotton trade, and trained up many of the most successful printers and manufacturers in Lancashire. The history of the two houses, the Peels of Bury, and the Peels of Church, is, indeed, the history of the spinning, weaving, and printing of Lancashire for many years.

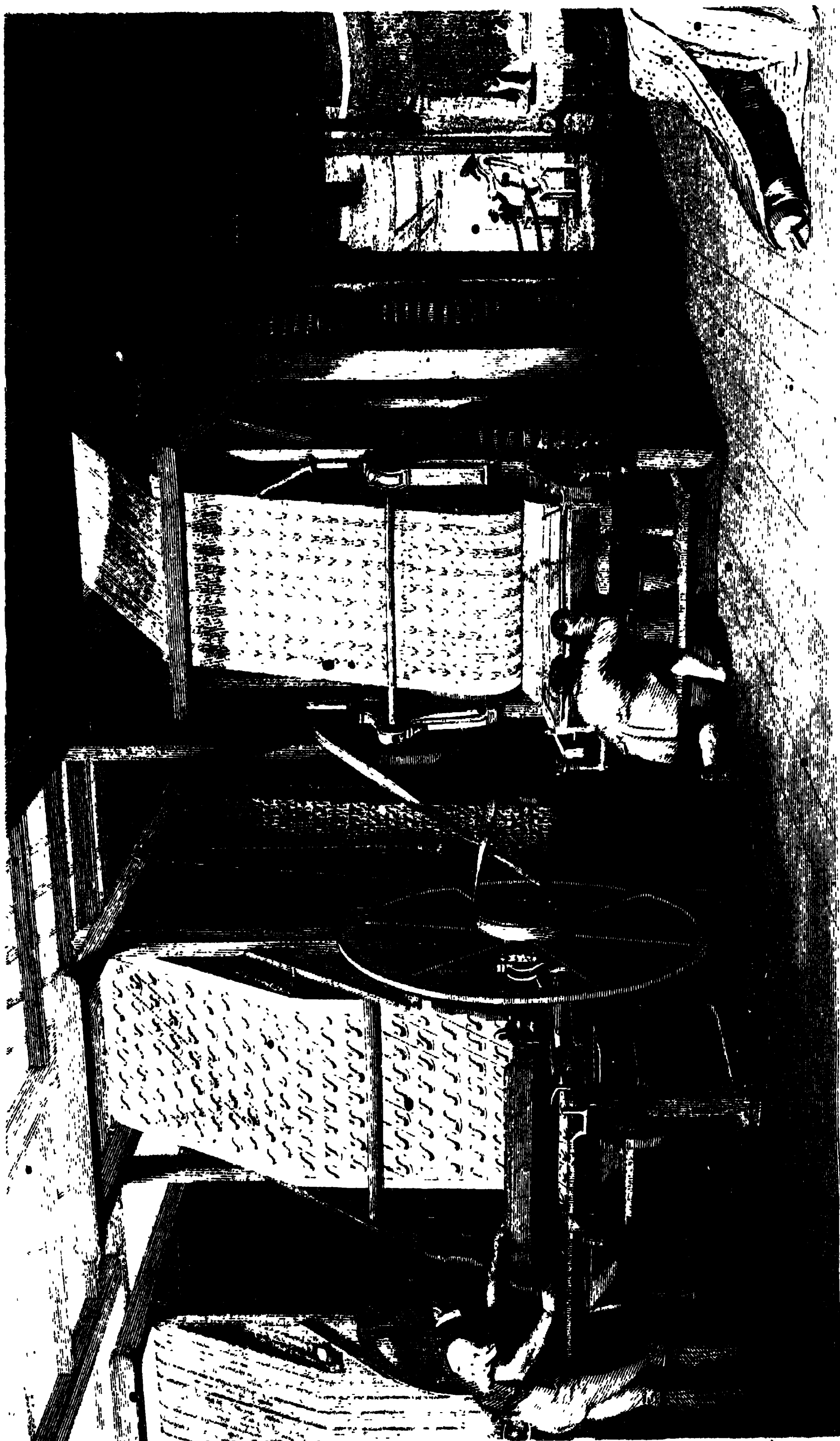
Calico printing has been the subject of modern improvements, which may be compared in importance with those in cotton spinning and bleaching; and most of these improvements have either originated or been matured and perfected in Lancashire. The old method of printing—still continued for certain parts of the work—was by blocks of sycamore, about ten inches long by five broad, on the surface of which the pattern was cut in relief, in the common method of wood engraving. On the back of the block was a handle, by which the workman held it: the surface was applied to a woollen cloth stretched over a vessel containing the colour, and in contact with that colour, so as to be saturated by it, and was then laid upon the piece of cloth, (there being wire points at the corners of the block, to enable the workman to apply it with exactness,) and struck with an iron mallet. Thus the figure was impressed upon the cloth, one colour only being used at once; and if other colours were required to complete the pattern, it was necessary to repeat the operation with different

blocks. In order to produce more delicate patterns than could be engraved on wood, copper-plates were introduced in the neighbourhood of London, and the cloth was thus printed from flat plates, with the kind of press used in copper-plate printing. Each of these modes was tedious, as no more of the cloth could be printed at once than was covered with the wooden block or copper plate; and a single piece of calico, twenty-eight yards in length, required the application of the block 448 times.

The grand improvement in the art was the invention of *cylinder printing*, which bears nearly the same relation in point of despatch to block printing by hand, as throstle or mule spinning bears to spinning by the one-thread wheel. This great invention is said to have been made by a Scotchman of the name of Bell, and it was first successfully applied in Lancashire, about the year 1785, at Mosney, near Preston, by the house of Livesey, Hargreaves, Hall, and Co., celebrated for the extent of their concerns, and the magnitude of their failure in 1788, which gave a severe shock to the industry of that part of the country. This new mode of printing may be thus described:—A polished copper cylinder, several feet in length, (according to the width of the piece to be printed,) and three or four inches in diameter, is engraved with a pattern round its whole circumference, and from end to end. It is then placed horizontally in a press, and, as it revolves, the lower part of the circumference passes through the colouring matter, which is again removed from the whole surface of the cylinder, except the engraved pattern, by an elastic steel blade, placed in contact with the cylinder, and reduced to so fine and straight an edge as to take off the colour

without scratching the copper. This blade has received the name of the *doctor*, which may be a workman's abbreviation of the word *abductor*, applied to it from the purpose which it answers; or may have been given from a vulgar use of the word *to doctor*, meaning to set to rights. The colour being thus left only in the engraved pattern, the piece of calico or muslin is drawn tightly over the cylinder, which revolves in the same direction, and prints the cloth. After the piece is printed, it passes over several metallic boxes, six feet long, ten inches broad, and six inches deep, heated by steam, which dry it. A piece of cloth may be thus printed and dried in one or two minutes, which by the old method would have required the application of the block 448 times. Nor is this all. Two, three, four, and even five cylinders may be used at the same time in one press, each cylinder having engraved upon it a different portion of the pattern, and being supplied with a different colour. The piece passes over them successively, and receives the entire pattern almost in the same moment. To produce the same effect by hand block printing, would have required 896, 1344, 1792, or 2240 applications of the blocks, according as 2, 3, 4, or 5 cylinders may have been employed. The saving of labour, therefore, is immense: one of the cylinder printing machines, attended by a man and a boy, is actually capable of producing as much work as could be turned out by one hundred block printers and as many tear-boys! In consequence of the wonderful facility given to the operation, three-fourths of all the prints executed in this country are printed by the cylinder machine. (Pl. 14.)

But the course of improvement did not stop here.



Another admirable invention, analogous to that just described, multiplied the advantages of cylinder printing. The process of engraving itself, instead of being executed by the graver on the whole surface of the copper cylinder, is now performed by mechanical pressure, which *transfers* the pattern from a very small steel cylinder, only about three inches in length and one in diameter, to the copper cylinder three or four feet in length. The principle of this invention is the same which Mr. Jacob Perkins applied to the multiplication of plates for the printing of bank notes, and Mr. Perkins has the reputation of being its inventor; but the process had been practised in Manchester some years before he came from America to settle in London.

Mr. Joseph Lockett, engraver for calico printers in Manchester, introduced this system about the year 1808: he may be considered as at least one of the inventors, and he certainly did more than any other person to perfect it. The method of transferring is as follows:—The pattern intended to be engraved is so arranged in the first place by a drawing made to agree with the circumference of the copper cylinder, as that it will join and appear continuous when repeated. This is then carefully followed by the engraver, and cut or sunk on a small steel cylinder, about three inches long and one thick, so softened or decarbonized as to admit of being easily cut. The steel is then tempered or hardened, and by means of pressure against another cylinder of softened steel, a fac simile is made *in relief*, that is, raised upon the surface. The second cylinder is then hardened in the same way, and it becomes hard enough to impress the whole engraving, even to the most delicate lines, on the copper cylinder, when pressed

against it in a machine. The small cylinder originally engraved is called the *die;* the second cylinder, which is in relief, is called the *mill.* The latter is successively applied to the whole circumference of the copper cylinder, which is thus entirely covered with the pattern, as finely wrought as if it had been directly produced by the tool of the engraver. The surface of the die originally engraved is not more than about one-fiftieth part of the surface of the copper cylinder, and the engraving itself is therefore multiplied *fifty-fold.* By this means the most delicate designs, which would occupy an engraver many months to effect by hand, can be completed in a few days; of course the cylinders are produced at a much less price, and they may be executed in a very superior manner. Should the copper cylinder be so far worn as to require the pattern to be re-engraved, it can be done by the same process with amazing rapidity, and at a very trifling cost, as the mill is already prepared.

Other modes of transferring are practised. In some cases the die is cut on a flat surface, and the pattern transferred in relief to a cylinder, which again transfers it to the copper cylinder at proper distances on the surface. In other cases the die is cylindrical, and the mill flat. When the design is very small, and requires to be repeated a great number of times on the copper cylinder, the pattern is engraved round the whole of the steel cylinder, so as to join or meet in the circumference, and at such equal distances that every repetition, or part forming the pattern, will fall into its fac-simile, like the teeth in a wheel. The mill is then placed in contact with and compressed into the copper cylinder by means of machinery, which is made to traverse by a spiral

movement until the whole of the copper cylinder is covered. By this means the most minute patterns are produced, such as human ingenuity could not accomplish by any other method.

There are various modes of softening and hardening the steel cylinders. The common mode of softening the steel is, to put it into an iron case surrounded with a paste made of lime, cow's gall, and a little nitre and water, then to expose the case to a slow fire, which is gradually increased to a considerable heat, and afterwards allowed to go out, when the steel is found to be soft and ready for the engraver. To harden the steel, it is placed in an iron case with bone-dust or scrapings, exposed to a slow fire, and after being gradually raised to a certain heat, which is indicated to the practised eye by its colour, it is taken out and plunged into cold water. Stale water with a mixture of salt is preferred. To make the mill, iron of a fine quality is often employed; and in that case, charcoal and a little salt are added in the hardening.

Sometimes the copper cylinders are etched, instead of being engraved,—a plan invented by Mr. John Bradbury, of Manchester, extensively practised by Messrs. Joseph Lockett, jun. and Co., and which is likely to prove of very great benefit to the printing business. The polished cylinder, having been heated, is covered with a thin coat of varnish, such as is used by historical engravers. The pattern is then traced on the cylinder with a diamond-pointed tracer, by means of a most complicated and ingenious system of machinery, the invention of Mr. Lockett, sen.; and the varnish having been thus removed from the figure, the cylinder is immersed in aqua-fortis, and the parts exposed become corroded or engraved. The value of

this process depends entirely on the beauty and novelty of the pattern. The tracing machinery is capable, like the kaleidoscope, of producing an endless variety of patterns, yet without being, like that instrument, dependent on mere accident for its changes. It has been so far perfected, that it will follow to a considerable extent designs made by persons perfectly unacquainted with its construction; and patterns may be produced by it, which cannot be copied, or in many instances even imitated, by any other means.

So great is the reputation acquired by the engravers of Manchester, from their skill and the perfection of their machinery, that orders are sent there for engraved cylinders from all parts of Europe and America, where cylinder printing is practised; even though the cost and risk of getting them to their destination should treble or quadruple their original price. It is superfluous to remark that the English calico printers possess a great advantage over their foreign competitors, from the cheapness of engraving in this country, and the variety of patterns they can command.

The beautiful and admirable inventions we have described, do not complete even the mechanical improvements in calico printing. It is still found necessary to execute parts of the patterns in fine goods with blocks, after the ground-work has been laid on by the cylinders; because different parts of the pattern, executed with different colours, cannot be made so exactly to fall into and fit with the other parts, by the cylinder as by the block. About the year 1802, an important improvement was made in the construction of blocks, for which the art is indebted to the workmen of London. Formerly all the blocks were cut in wood, like ordinary wood-cuts used in the prints of books, but the work was necessarily

coarser, to endure the wear and tear of so many impressions: each piece of cloth, as has been stated, requires the application of the block 448 times, and, of course, 100 pieces would require its application 44,800 times. If the design, therefore, was fine and elaborate, the block would soon wear away. The improvement effected removes this objection The pattern, instead of being cut in relief on the wood, is (in many cases) raised on the surface of a plain block, by pieces of flat copper or brass wire, of various thicknesses and forms, produced by drawing the wire through dies of various shapes. These pieces of wire are let into the wood, and all stand exactly the same height, namely, about the eighth of an inch. The thicker parts of the pattern have merely the outline formed of copper, and they are filled up with felt. Blocks on this improved construction are ten-fold more durable than the old wooden blocks, and when the metal is worn down nearly to the surface of the wood, the last impression is as good as the first.

The successful application of engraved copper cylinders to printing was followed by that of cylindrical blocks, or engraved wooden rollers. This mode of printing, which is practised extensively in some establishments, is called *surface-printing*. The union of the two systems in the same machine, that is, of a wooden cylinder in relief with an engraved copper cylinder, forms what has been denominated the *union* or *mule machine*, and was the invention of Mr. James Burton, about the year 1805, whilst he was engineer in the establishment of Messrs. Peel and Co., of Church.

Many minor improvements have been made in the mechanical department of calico printing; but those which have been described are by far the greatest, and, for ingenuity and beauty, as well as for productive

power, they well deserve to rank with the more celebrated inventions in cotton spinning.

The chemical department of printing has been not less rich in discoveries than the mechanical. At the head of these stands the grand discovery of the properties of chlorine, already mentioned in the description of bleaching, and which are of important use in several stages and processes of printing, as well as in whitening the cloth. Whenever in the course of printing the calico is to be freed from stain or discoloration, the solution of chloride of lime is used: and by the aid of this powerful agent, a rich chintz, which formerly required many weeks to print, in the summer season, when it could be laid on the grass exposed to the air and sun, is now produced without ever going from under the roof of the factory, and almost in as many days.

In a popular History of the Cotton Manufacture, it would be out of place to discuss the properties of the drugs and chemical substances used in dyeing, or to describe with minuteness the various processes of that art. The author must confine himself to a brief and general notice, such as may give to the unscientific reader an idea of the most important operations to which the cloth is subjected in the hands of the calico printer.

It has been remarked that cotton fabrics are very rarely dyed of a uniform colour. Sometimes a flower, stripe, or other figure, is printed on a white ground; and at other times the pattern only is white, and the rest of the cloth dyed. The proper use of *mordants* lies at the foundation of the dyer's art. The nature of mordants is thus explained by Dr. Thomson:—

"The term mordant is applied by dyers to certain substances with which the cloth to be dyed must be

impregnated, otherwise the colouring matters would not adhere to the cloth, but would be removed by washing. Thus the red colour given to cotton by madder would not be fixed, unless the cloth were previously steeped in a solution of a salt of alumina. It has been ascertained that the cloth has the property of decomposing the salt of alumina, and of combining with and retaining a portion of alumina. The red colouring principle of the madder has an affinity for this alumina, and combines with it. The consequence is, that the alumina being firmly retained by the cloth, and the colouring matter by the alumina, the dye becomes fast, or cannot be removed by washing the cloth with water, even by the assistance of soap, though simple water is sufficient to remove the red colouring matter from the cloth, unless the alum mordant has been previously applied. The term *mordant* (from the Latin word *mordere*, to bite) was applied to these substances by the French writers on dyeing, from a notion entertained by them that the action of the mordants was mechanical; that they were of a corrosive or biting nature, and served merely to open pores in the fibres of the cloth, into which the colouring matter might insinuate itself. And after the inaccuracy of this notion was discovered, and the real use of mordants ascertained, the term was still continued as sufficiently appropriate, or rather as a proper name, without any allusion to its original signification. The term *mordant*, however, is not limited to those substances merely which serve, like alumina, to fix the colours. It is applied also to certain substances, which have the property of altering the shade of colour, or of brightening the colour, as it is called."*

* Encyclopædia Britannia, 7th edition, article "Dyeing."

The most valuable of all mordants is the acetated aluminous mordant, first employed by the calico printers of this country, and the discovery of which would have been worthy to form an era in the art, if it were not that its application was the result of accident rather than of science, and that it was long used empirically and ignorantly, together with several other ingredients which were perfectly useless. Alum was employed by the English calico printers, as it had been for ages in India, and guess seems to have led some of them to put in sugar of lead together with the other materials; by the combination of these two, acetate of alumine was formed, but amidst the number of ingredients employed the printers did not know which produced the effect. By degrees they found out that sugar of lead and alum were the most important, and they discarded first one and then another of the ingredients they had been accustomed to mix with them, though without the aid of any chemical reasoning. It has been supposed that the Indians employed the acetate of alumine, but Dr. Bancroft says—"they neither had, nor have they at present, any knowledge of the use of sugar of lead, or of any other preparation of that metal, which could produce similar effects in calico printing; a solution of common alum in water being their only aluminous mordant, and the previous application of the soluble parts of myrobalans and of buffaloes' milk to their calicoes, aided by a very hot sun-shine, and the complete desiccation which it produces, enabling them, without any thing like an acetate of alumine, to give equal durability to their colours."*

The process of cylinder printing is very commonly

* Bancroft's Philosophy of Permanent Colours, Vol. I. p. 370.

employed to fix the mordant on the cloth, which is afterwards put into the dye vat, when those parts only receive the colour which had previously been printed with the mordant, the other parts remaining white.

Several modern improvements in calico printing claim particular notice.

An attempt in Scotland to imitate by another process those handkerchiefs of Indian origin, in which white spots or squares were produced by tying up the portions intended to be reserved white, and thus protecting them from the mordant or dye, gave birth to the system of printing which is called *discharge-work*. In this system the parts intended to be kept white are printed with acid,—lemon juice, or citric acid, being chiefly used for this purpose. The cloth is then wholly immersed in the mordant, and quickly dried; or, being first impregnated with the mordant, the design or pattern is printed in acid, which removes it. This is reversing the original process, which was to apply the block or cylinder to those parts of the cloth intended to be coloured. In the process of drying, which is called *padding*, fans are used, as well as the steam boxes, and by the use of the fans one-third less fuel is needed.

Such is the origin of this great and permanent improvement and extension of the process of printing. It was tried with partial success in Scotland and in London for a few years; but it was not 'till about the year 1801 that it was adopted and perfected by the Lancashire houses, amongst whom the Peels, of Church, were the first to practise it successfully and extensively.

This was soon followed by the discovery of the process for producing what has been named *resist work*, or

neutral work, the meaning of the latter term not being very obvious. It consists in printing various mordants on those parts of the cloth intended to be coloured, and a paste or *resist* on such as are intended to remain white. The cloth is immersed in the indigo vat for a few seconds; and when taken out, the parts covered with the paste are found to have kept out the blue dye; hence this is called resist work. This system is of most extensive application, and has given a new face to the productions of calico printing. It is the invention of a person named Grouse, a traveller for a London house, possessing little practical and less scientific knowledge, fond of experiments and dabbling by the fire-side in the processes of printing. The same individual discovered the mode of dyeing *bran pink*, for which ten London printers subscribed and gave him one hundred guineas. His process for resist work he sold for *five pounds!* It required the experience of a year or two to perfect this system, and make it practically useful. The house of Sir Robert Peel, of Bury, was the first to print by this plan so as to attract notice, about the year 1802: it is now one of the most beautiful and perfect of the operations of modern calico printing.

The art of dyeing the fine red, called Turkey or Adrianople red, on thread or yarn, has long been practised in the Levant, and subsequently in Europe. About forty years ago it was introduced in Glasgow by a Frenchman, M. Papillon, who established a dye-work with Mr. Mackintosh, and that city has ever since been famous for dyeing Turkey red.* The art of giving this

* Mr. John Wilson, of Ainsworth, near Manchester, an extremely ingenious dyer and manufacturer, who more than sixty years since gained both celebrity and wealth by the great improvements he introduced into the art of dyeing, had

colour to *cloth* was unknown till the year 1810, when it was first practised by M. Daniel Koechlin, of Mulhausen, in Alsace. The discovery which has immortalized the name of this gentleman in the annals of calico printing was made the following year. It consists in printing upon Turkey red, or any dyed colour, some powerful acid, and then immersing the cloth in a solution of chloride of lime. Neither of these agents singly and alone affects the colour, but those parts which have received the acid, on being plunged in chloride of lime, are speedily deprived of their dye, and made white by the acid of the liberated chlorine. This is one of the most beautiful facts in the chemistry of calico printing.

For this process a patent was obtained in this country, by Mr. James Thomson, of Primrose, near Clitheroe, in the year 1813; and the same gentleman, in 1816, took

obtained from the Greeks of Smyrna the secret of dyeing Turkey red, which he described in two essays read by him before the Literary and Philosophical Society of Manchester; but it is stated, that "he found this too tedious and expensive a "process, less suited to manufactured goods than to cotton in the skein; nor even "suited to that spun upon the single spindles then in use, though it might be "applicable enough to that spun on machines." *Aikin's Hist. of Manchester*, p. 165. Mr. Thomas Henry, in a paper on the Art of Dyeing, read before the above-mentioned Society in 1786, says,—"great improvements have been made "in dyeing within these few years,—improvements principally owing to the "ingenuity and public spirit of Mr. Wilson, of this Society; who by the applica-"tion of chemical principles, and by a diligent investigation of the nature of "colouring substances, laid the foundation on which the present fabric is erected." *Memoirs of the Manchester Lit. and Phil. Society*, vol. iii. p. 318.—Mr. Wilson's essays and his recipes are quoted with respect both by Berthollet in his "Art of Dyeing," and by Dr. Bancroft, in his "Philosophy of Permanent Colours."—We learn from the paper of Mr. Henry quoted above, that a M. Borelle, a Frenchman, also introduced the art of dyeing Turkey red at Manchester; which must have been several years previous to M. Papillon's going from France to Glasgow; and he obtained a grant from government for the disclosure of his plans, as M. Papillon afterwards did from the Commissioners and Trustees for Manufacturers in Scotland. But the method of the latter seems to have obtained the most decided success.

out a second patent for a very useful and happy modification of the principle of the former one, namely, for combining with the acid some mordant, or metallic oxide, capable, after the dyed colour was removed, of having imparted to it some other colour. This laid the foundation of that series of processes, in which the chromic acid and its combinations have since been employed with such great success.

A bronze colour, so extensively used in common prints, was first produced from solutions of manganese by Messrs. Hartman, of Munster, about the year 1822. Cloth impregnated with sulphate or muriate of manganese, and then passed through caustic alkali, becomes, by the absorption of oxygen and the per-oxidation of the white oxide of manganese, a deep rich brown, unalterable by light and air. The cheapness of this metallic dye, and its permanence, have brought it into extensive use in calico printing; but, more than all, a series of beautiful processes, founded on the proportions and combinations of manganese and chrome, in which the resources of a refined chemistry have been applied with the happiest success.

The discovery of new facts, as well as the ingenious application of known ones, has enabled Mr. Mercer, of Oakenshaw, to make the *bronze* style his own, and literally to transmute the ores of manganese into ores of gold. This ingenious individual possesses a store of knowledge and facts unknown to scientific chemists, and sought for in vain in their latest works. It is to be hoped he will have both leisure and inclination at some time to communicate a portion of his labours to the world.

For most of the facts in the above outline of the

mechanical and chemical improvements in calico printing, I am indebted to gentlemen whose authority is inferior to none in the trade; and especially to one gentleman, who combines in an eminent degree scientific with practical knowledge, Mr. Thomson, of Primrose.

By the various inventions, discoveries, and improvements made in calico printing, the trade flourished and increased, notwithstanding the weight of duties and the vexation of excise regulations. To these annoyances the printing business was subjected from its very infancy down to the year 1831. The duties imposed in 1712 and 1714, and the prohibition to print or dye calicoes in 1720, have already been noticed. In 1774, parliament removed this prohibition as regards English calicoes, and allowed them to be printed on paying an excise duty of 3d. per square yard. In 1779 and 1782, three several additions of 5 per cent., making in the whole 15 per cent., were made to that duty.

In 1784, when Mr. Pitt imposed new taxes to repair the finances of the country injured by the American war, he taxed not only printed but even *bleached* goods, and compelled the bleachers, printers, and dyers, to take out licences, for which the sum of £2 was to be paid annually. By the act passed for this purpose, the 24 Geo. III. c. 40, he laid a new duty on all cottons and mixed goods of 1d. per yard, if bleached or printed, under 3s. per yard in value, and 2d. on all above that value, in addition to the former duties of 3d. per yard; and 15 per cent. additional was charged on the new duties as well as on the old. These impositions excited great alarm and discontent throughout Lancashire and all the cotton manufacturing districts of England and Scotland; petitions to the House of Commons, and

memorials to the Lords of the Treasury, were sent up, representing that these new duties would crush the rising manufacture, and render the English altogether unable to compete with Indian goods, brought from a country producing the raw material and every article used in the manufacture, and where labour was exceedingly cheap. Deputations were also sent from Manchester, Bolton, and other places, to remonstrate with the minister; the manufacturers were heard by counsel at the bar of the house, in the session of 1785, and much evidence was given; and so forcible were the representations made, that Mr. Pitt reluctantly consented to bring in a short bill (25 Geo. III. c. 21.) repealing all the new duties imposed by the bill of the previous year, on the linen and cotton manufactures. The repeal was celebrated as a jubilee in Lancashire; and when Mr. Thomas Walker and Mr. Richardson, who had been especially active in the application to government, returned from London, they were honoured with a triumphal entrance into Manchester, being met by a procession which extended nearly from that town to Stockport, and which is celebrated as one of the most joyous and splendid processions ever seen in Lancashire. The inhabitants of Manchester and Bolton presented silver cups to these gentlemen, with inscriptions, acknowledging their valuable exertions.

In the same year, however, a considerable addition was made to the former duties on cotton, linen, and mixed goods. By the 25 Geo. III. c. 72, all cottons, muslins and stuffs, of which cotton formed a part, when printed, painted, dyed, or stained, were made liable to an additional duty of 2d. per yard, if of the value of 1s. 8d. and not more than 3s. per yard; and to a duty

of 4d. per yard, if worth more than 3s. The addition of 15 per cent. was also charged upon these duties, as well as upon the duty of 3d. per yard imposed in 1774. Therefore the duties stood thus:—

	Duty imposed in 1774.	Additional Duties imposed in 1785.	15 per Ct. on the whole.	Total Duty
	Per Yard	Per Yard.		Per Yard.
Above the value of 1s. 8d. and not above 3s.	3d.	2d.	$\frac{3}{4}$d.	5$\frac{3}{4}$d.
Above the value of 3s.	3d.	4d.	1d. 1-5	8d. 1-5

These duties, therefore, on the average more than doubled the duties existing previously to 1784, but they only applied to printed goods, not to goods which were merely bleached.

On the consolidation of the customs in 1787, all former duties were repealed, and cotton, linen, or mixed goods of every kind were subjected to a duty of 3½d. per square yard, when printed or dyed. The whole duty was returned by drawback on the exportation of the goods. At the same time, foreign calicoes and muslins were charged with a duty of 7d. per square yard, when printed or dyed in Great Britain.

To encourage the art of designing original patterns for printing on calicoes, muslins, and linens, parliament vested in the proprietors the sole right of vending the goods printed with original patterns, for two months after the day of publishing them: and this act, passed in 1787, (27 Geo. III. c. 28,) has been continued by subsequent statutes to the present time, with an enlargement of the term of copyright to three months.

The duties fixed in 1787 continued till 1831, when the chancellor of the exchequer, Lord Althorp, on the earnest representations of the calico printers, entirely remitted the duty, and released the trade from the shackles of the excise. The duty was extremely objectionable on various grounds. It took upwards of two millions out of the pockets of the calico printers, yet only brought about half a million into the exchequer, and, deducting the expenses of collection, only about £350,000: a million and a half was returned as drawback on exportation. This opened a wide door, and presented a strong temptation, to fraud and perjury, which were of daily occurrence. The restrictions, delays, and expenses, to which it subjected the calico printers, were estimated as imposing a tax of £200,000 a year on the trade. The duty increased the cost of prints on the average 30 to 40 per cent.; but, being of the same amount on all qualities, it pressed most unequally and unjustly; on the common prints, worn by the poor, it amounted to 70 or 80 per cent., whilst the fine prints, worn by the rich, only paid 10 or 15 per cent. The tax was, indeed, so annoying to the printers, and weighed so heavily on the commodity, that nothing but the series of wonderful discoveries and inventions which has been exhibited, could have made the trade increase under it. With that mighty help, however, it did increase very rapidly. In 1796, the quantity of British calicoes and muslins, which paid the print duty, was 28,621,797 yards; in 1829, it was 128,340,001 yards.

The following table shews the gross produce of the excise duty on printed calicoes and muslins in the year 1796 and 1800, but it does not exhibit the drawback.

Calicoes and Muslins printed in Great Britain, in 1796 and 1800.

	Rate of Duty.	1796. Yards.	1796. Amount of Duty.	1800. Yards.	1800. Amount of Duty.
In England.					
Foreign Calicoes & Muslins	7d.	1,750,270	£51,019	1,577,536	£16,011
British do. do.	3½	21,363,240	355,297	28,692,790	418,43[illegible]
In Scotland.					
Foreign Calicoes & Muslins	7d.	111,103	4,124	78,868	2,[illegible]50
British do. do.	3½	4,258,557	62,103	4,176,939	60,913

By the subjoined table, the gross and net produce of the duty, with the number of pieces of calicoes, muslins, &c. printed, exported, and retained for home consumption will be seen for the years 1815, 1820, 1825, and 1830. the last being the year before the repeal of the duty:

Calicoes, Muslins, &c. printed in Great Britain, from 1814 to 1830.

Years.	Calicoes, &c. printed at an average duty of [illegible] per piece.	Duty on printed calicoes received by government.	Calicoes exported, &c. [illegible] per piece.	Drawback paid by government on printed calicoes, &c. exported.	Calicoes, &c. taken for home consumption, at an average duty of [illegible] per piece.	Net amount of duty rec'd by government on calicoes, &c. for home consumption.
	[illegible]	£.	Pieces.	£	Pieces.	£.
1814	5,192,225	1,228,057	3,324,160	831,040	1,868,068	167,017
15	[illegible]	1,331,66[illegible]	3,813,000	953,250	1,513,652	278,413
16	[illegible]	1,127,811	2,878,701	719,676	1,652,5[illegible]	108,135
17	[illegible]	1,173,816	3,282,216	220,554	1,413,018	353,262
18	[illegible]	1,570,636	1,317,508	1,072,377	1,965,036	191,2[illegible]9
19	[illegible]	1,181,643	3,519,868	879,967	2,118,701	601,576
1820	[illegible]	1,614,015	3,727,820	931,955	1,728,349	682,085
21	7,095,181	1,771,371	1,323,661	1,083,116	2,671,820	567,955
22	6,739,808	1,682,702	1,730,228	1,182,557	2,000,580	500,115
23	7,317,676	1,816,919	1,587,001	1,116,751	2,660,672	570,168
24	8,162,872	2,040,71[illegible]	5,527,761	1,381,911	2,655,108	658,677
25	8,140,870	2,035,219	6,662,368	1,665,592	[illegible],178,505	569,627
26	6,098,656	1,524,661	1,082,684	1,020,671	2,015,972	503,903
27	8,089,028	2,022,257	5,110,272	1,360,068	2,618,756	662,189
28	8,39[illegible]548	2,098,962	5,769,828	1,111,207	2,631,020	657,755
29	7,768,072	1,912,015	5,562,136	1,390,534	2,105,936	551,481
1830	8,596,962	2,149,238	6,315,110	1,578,860	2,281,512	570,378

The following calculation was made in 1830 by an extremely well-informed calico printer, of the number of individuals employed in the printing trade, and in the manufacturing of the cloth printed:—

"The duty is in round numbers £2,000,000, which is equal to 8,000,000 pieces of prints.

	s.	d.
Average price of printing cloth, per piece	7	0
Deduct the value of the raw material	2	6
	4	6
Deduct for profits of machinery, &c.	1	0
Supposed amount paid in wages on each piece . . .	3	6

8,000,000 pieces of cloth—wages for spinning and weaving, at 3s. 6d.	£1,400,000
Average of wages for printing do. at 2s. 6d. .	1,000,000
	£2,400,000

Or equal to £46,154 of wages paid *weekly* for labour in spinning, weaving, and printing: the average of which is about 8s. per head; divide £46,154 by 8s. and there results 115,385 individuals employed in spinning, weaving, and printing; and it may be said that as many more are dependent upon them—thus giving 230,770 individuals, employed in and dependent upon the printing trade. It is presumed that a repeal of the print duty would give an increased employment of 12½ per cent.,—making the total 259,366 individuals dependent on the prosperity of the printing trade."

The repeal of the print duty has proved highly beneficial, having given a stimulus both to production and to improvement. To the consumer it is a great relief, especially to the poor, as a woman can now buy a useful and respectable printed dress for *half-a-crown*, which, before the repeal of the duty, would have cost nearly

four shillings. Indeed a printed dress of good materials and a neat pattern, with fast colour, may now be bought for two shillings.

The large print-works of Lancashire are among the most interesting manufactories that can be visited. Several of the proprietors or managers are scientific men; and, being also persons of large capital, they have the most perfect machinery and the best furnished laboratories. All the processes through which the cloth has to pass, from the state in which it is left by the weaver, till it is made up a finished print ready for the foreign or home market, are performed in these extensive establishments. The bleaching, the block printing, the cylinder printing, the dyeing, the engraving both of blocks and cylinders, the designing of patterns, and the preparation of colours, all go on within the same enclosure. Some of the print-works employ as many as a thousand work-people. The order and cleanliness of the works, and the remarkable beauty of most of the operations, impress the visitor with admiration and surprise. A printing establishment, like a cotton mill, is a wonderful triumph of modern science; and when the mechanical and chemical improvements of both are viewed together, they form a splendid and matchless exhibition of science applied to the arts, and easily account for a rapidity of growth and a vastness of extension in the manufacture, which has no parallel in the records of industry.

CHAPTER XIII.

COTTON-WOOL.

Natural history of cotton-wool.—Annual herbaceous cotton.—Mode of cultivation, in America and India.—Shrub cotton; its varieties, countries where found.—Tree cotton.—The silk cotton tree.—Dwarf cotton.—Cotton requires a dry and sandy soil.—The best grown on the sea-coast.—Sea Island cotton.—Salt a chief cause of its excellence.—American Report concerning the growth of this cotton.—Selection of seed.—First introduction of long-stapled cotton into the United States.—Short-stapled cotton, called Upland and Bowed Georgia.—Modes of separating the cotton from the seeds.—Roller mill.—Mr. Whitney's saw-gin.—Extensive cultivation of cotton in the United States. Exports from that country.—Growth from 1819 to 1832.—Different sources from which England is supplied.—Bourbon cotton; West Indian; Demerara, Pernambuco.—Recent and successful cultivation of long-stapled cotton in Egypt; imports of Egyptian cotton from 1823 to 1833; Egyptian cotton manufacture.—Indian cotton.—Imports of cotton-wool from different countries from 1820 to 1833.—Distinguishing qualities of cotton.—Prices of different kinds from 1782 to 1833.—Tables of import, consumption, &c.—Great fall in the price of cotton. Its principal cause, the extended cultivation in America.—Mutual dependence of the English spinner and the American planter.—Freight.—Mode of consignment.—Mode of selling and buying cotton at Liverpool.

Having completed that portion of the history of the Cotton Manufacture which comprises the mechanical and chemical improvements, it will be proper to give some account of the raw material, cotton-wool, before proceeding to bring down the commercial history to the present period.

Cotton, or cotton-wool, is a vegetable down, the produce of a plant growing in warm climates, and indigenous in India and America. The name of the genus is *Gossypium*, and there are many varieties.

The cotton is contained in the seed vessels, and adheres closely to the seeds of the plant. Linnæus enumerated five species of the cotton plant:—

1. *Gossypium herbaceum*, or herbaceous.
2. *G. arboreum*, or arborescent.
3. *G. hirsutum*, or hairy.
4. *G. religiosum*, or religious.
5. *G. Barbadense*, or Barbadoes.

Lamarck, in the Encyclopédie Méthodique, enumerates eight species of the cotton plant; Cavanilles and Willdenow recognize ten. According to the latter, the following species are distinct from each other:—

1. *Gossypium herbaceum.*	6. *G. hirsutum.*
2. *G. Indicum.*	7. *G. religiosum.*
3. *G. micranthum.*	8. *G. latifolium.*
4. *G. arboreum.*	9. *G. Barbadense.*
5. *G. vitifolium.*	10. *G. Peruvianum.*

It will be sufficient for the purpose of this work to point out the three great distinctions, 1st. *herbaceous cotton*: 2d. *shrub cotton*; 3d. *tree cotton*; each of which has several varieties, so that some cotton planters have recognized not fewer than a hundred kinds, and the plant seems to have a great tendency to run out into varieties.

The 1st and most useful species of cotton is the *herbaceous*, which is an annual plant, cultivated in the United States, India, China, and many other countries. It grows to the height of eighteen to twenty-four inches, and has leaves of a bright dark green colour, marked

with brownish veins, and each divided into five lobes. Its blossom expands into a pale yellow flower, like that of a mallow, having one large pistil and five petals or leaves, with a purple spot at the bottom of each. When the flower falls off, a capsular pod appears, supported by three triangular green leaves, deeply jagged at their ends: the pod approaches to the triangular shape, with a pointed end, and has three cells. It increases to the size of a large filbert, and becomes brown as the woolly fruit ripens; the expansion of the wool then causes the pod to burst, when it discloses a ball of snow-white or yellowish down, consisting of three locks, one in each cell, enclosing and firmly adhering to the seeds, which in form resemble those of grapes, but are much larger.

The seed is planted in March, April, and May; and the cotton is gathered by hand, within a few days after the opening of the pods, in August, September, and October. In America it is planted in rows five feet asunder, and in holes eighteen inches apart, in each of which several seeds are deposited: careful weeding of the ground is necessary, and the plants require to be gradually thinned, so as ultimately to leave only one or two for each hole; they are also twice pruned, by nipping off the ends of the branches, in order to make them put out more branches, and yield a larger quantity of blossom and fruit. A field of cotton at the gathering season, when the globes of snowy wool are seen among the glossy dark green leaves, is singularly beautiful; and in the hottest countries, where the yellow blossom or flower, and the ripened fruit, are seen at the same time, the beauty of the plantation is of course still more remarkable. In India, the mode of cultivation is most slovenly, as the seed is sown broadcast, and the

plant is neglected at every stage of its growth; which, together with the carelessness of the natives in gathering the cotton, in separating it from the seeds, and in packing it, makes the Indian cotton so much inferior to that of the United States.*

A representation of a branch of the herbaceous cotton, with the flower, and the pods open and closed, has been given at page 13; and the following shows the appearance of the plant when growing:—



Gossypium herbaceum—Herbaceous Cotton.

2d. The *shrub cotton* grows in almost every country where the annual herbaceous cotton is found. Its dura-

* For an account of Indian cotton, and its mode of cultivation and preparation, see pp. 61, 65.

tion varies according to the climate: in some places, as in the West Indies, it is biennial or triennial; in others, as in India, Egypt, &c. it lasts from six to ten years; in the hottest countries it is perennial; and in the cooler countries which grow cotton, it becomes an annual. In appearance, the shrub has a considerable resemblance to the currant bush. The principal varieties of shrub cotton are, the *Gossypium Indicum*, or the Indian, which attains the height of ten or twelve feet; the *G. vitifolium*, or vine-leaved, found in the Isle of France, in Celebes, and various parts of South America; the *G. hirsutum*, or hairy, (so called from its branches being covered with hair,) a low shrub, and a native of the hottest parts of America; the *G. religiosum*, or religious, (the reason of which name, given by Linnæus, is unknown,) which has an upright stem, and of which the flower changes from white to red, found in Surinam, India, &c.; the *G. latifolium*, or broad-leaved, resembling the *G. vitifolium*, and found in the West Indies; the *G. Barbadense*, cultivated chiefly in Barbadoes, and believed to be the same as the *G. Indicum*; and the *G. Peruvianum*, a Peruvian shrub not materially differing from the others. The flower and fruit of the shrub-cotton closely resemble those of the herbaceous cotton, but the pod is egg-shaped, not triangular and pointed. It is found, in one or other of its varieties, throughout the tropical parts of Asia, Africa, and America. The shrub is planted in holes seven or eight feet apart; eight or ten seeds are deposited in each hole, but only one of the stems which they produce is allowed to remain; the shrubs require to be pruned, and the plantations to be well weeded; and they seldom continue to yield good cotton more than five or six years, but in the hottest countries two crops

a year are gathered, one from October to December, and the other from February to April. The Guiana and Brazil cotton is of this kind.

The following is a representation of the shrub cotton:—



Gossypium religiosum—Shrub Cotton.

3d. The *tree cotton* grows in India, China, Egypt, the interior and western coast of Africa, and in some parts of America. As the tree only attains the height of twelve to twenty feet, it is difficult to distinguish the tree cotton and the shrub cotton, from the mention made of them by many travellers. In a passage quoted at p. 62, Marco Polo distinctly describes the cotton tree of Guzerat, which he states to be six yards high, and to

bear fruit for twenty years; but he adds, that the cotton taken from trees of that age is not adapted for spinning. Abu Zacaria Ebn el Awam, an Arabo-Spanish writer on agriculture and horticulture, of the twelfth century, informs us, that in Arabia the cotton tree grows to the size of the Armenian apple, and lasts twenty years. It is stated by Malte Brun that "the cotton tree grows on all the Indian mountains, but its produce is coarse in quality." Quotations from travellers might be multiplied, but they do not materially add to the information briefly given above. The following is a representation of the cotton tree:—



Gossypium Arboreum—The Cotton Tree.

There is still another tree, of very magnificent growth, attaining the height of a hundred feet, and with a peculiar spreading top, which bears a silky cotton of matchless softness, whiteness, and lustre, but of so short and brittle a fibre that it is unfit for spinning, and can only be used for the mean purpose of stuffing pillows and beds. This is called the *bombax ceiba*, and familiarly *the umbrella tree;* it is found in the Indian isles, in South America, the West Indies, and on the coast of Guinea, where it is said to be held in much veneration by the negroes; but, owing to its unfitness for manufacturing purposes, it would be superfluous here to do more than mention it.*

In the heart of Africa, near Timbuctoo, Réné Caillié saw a dwarf cotton, which rises only five or six inches above the ground; it is an annual, and with its wool the natives make a narrow cloth.†

The cotton plant, in all its varieties, requires a dry and sandy soil. This is the uniform testimony of travellers and naturalists. It flourishes on the rocky hills of Hindoostan, Africa, and the West Indies, and will grow where the soil is too poor to produce any other valuable crop. A mixture of siliceous and argillaceous earth is the most desirable, with a preponderance of the former. A marshy soil is wholly unfit for the plant, and so little congeniality has it for moisture, that a wet season is destructive to the crops. Of the several diseases to which cotton is subject, and which make the

* See Marsden's History of Sumatra, p. 126; Bolingbroke's Voyage to the Demerary, p. 253; Bowditch's Mission to Ashantee, pp. 24 and 326; Bryan Edwards's History of the West Indies, vol. ii. p. 268.

† Travels through Central Africa to Timbuctoo, vol. i. p. 426.

crop a precarious one, the most fatal is the blight produced by wetness at the roots.

The plant flourishes most, and produces cotton of the best quality, on the sea-coast.* It was mentioned, as long since as the twelfth century, by the Arabo-Spanish writer, Abu Zacaria, quoted above, that in Spain the sea-coast was found best suited to the cotton plant.† The same fact is familiarly known to the cotton planters of India, China, Demerara, and Western Africa.‡ And, above all, this proximity to the sea is proved to be indispensable to the growth of the best cotton, by the experience of the planters of South Carolina and Georgia, who raise the finest cotton known, namely, the Sea Island, on the sandy coasts and low islands of the sea, and who find the same cotton degenerate in length of staple and in quality when grown inland. The Hon. Whitemarsh B. Seabrook, the corresponding secretary of the Agricultural Society of St. John's Colleton, (South Carolina,) in a valuable "Report, accompanied with sundry letters, of the causes which contribute to the production of fine Sea Island Cotton," published in 1827, says—

* To this rule there are two exceptions. The Pernambuco cotton, which is only second to the Sea Island in value, though still much inferior, is said by Koster to be injured by proximity to the sea, and improved as the planters recede from the sea.—*Koster's Travels in Brazil*, p. 365. In Egypt also, "the cotton of the upper provinces, several hundred miles from the sea, is superior to that of the Delta."—*St. John's Travels in Egypt*, vol. ii. p. 438.

† Libro de Agricultura, tom. ii. c. xxii. p. 103.

‡ See p. 65. Mr. H. Bolingbroke, in his "Voyage to the Demerary," says that, "On the sea-coast the British settlers also commenced the culture of cotton, and found that land to answer much better than the soil up the river." p. 141. One reason which he alleges for the soil on the coast being more favourable to cotton than to sugar and coffee is, that it is of a "*saline*" quality. p. 201. In the Third Report of the Directors of the African Institution, it is stated that "the saline air of the sea-shore, which generally destroys coffee, is favourable to cotton." p. 23.

"The plantations of the gentlemen whose letters are under review, are similarly situated. Four of them are indented with creeks, and located on large rivers, and all of them, in point of effect, are *exposed to the salutary action of the ocean's spray.* In proportion to the distance from the sea-board, and to the want of a free circulation of air from the south, is, in general, the downward graduated scale of coarseness in the cotton produced. These causes operate increasingly as you recede from the ocean, until a point is reached at which long cotton cannot be profitably cultivated."

Salt appears to be the principal cause of making the cotton fine in quality and long in the staple. Hence, and from the sandy nature of the soil, the sea-coast is so favourable to the growth of cotton;* and hence it is established that salt mud is the best manure for a cotton plantation. Mr. Seabrook says—

"The cotton of Mr. Burden and his favoured associates, is indebted for its celebrity to the combined requisites of fineness, strength, and evenness of fibre. Upon what principles are these distinguished properties dependent? Those planters use, not only extensively, but almost exclusively, *salt mud.* This manure is known to impart a healthful action to the cotton plant, to maturate rapidly its fruit, and to produce a staple at once strong and silky. Mr. William Seabrook, senior, from a steadfast adherence to the application of salt mud, has literally converted a pine barren to as fruitful a soil as Edisto Island can boast. That siliceous and argillaceous soils, in the order narrated, are the best adapted for cotton, every cultivator of this article is well aware.

* See the quotations in the note, p. 295, from Bolingbroke's "Demerary," and the Report of the Directors of the African Institution.

* * * "From experiments by a member of this society, (Capt. Benj. Bailey,) it has been clearly demonstrated, that salt, added to a compost, in the ratio of one bushel of salt to every sixty bushels of compost, has been attended with the most decisive advantages in relation to the *quantum* and *quality* of cotton." "For every description of soil in which sand predominates, the secretary is warranted in averring that *salt clay mud* is the manure which will effect the double purpose of a *profitable* harvest, with its desirable correlative, a fine quality. Salt clay mud acts rather negatively than positively. It does not *add* very materially to the product of cotton, but, from its conservative and maturative power, the fruit, which the combined operation of soil and season may have disclosed, it is nearly certain of retaining and ripening. In a propitious season, stimulating manures will yield a larger crop than salt mud; but for a series of years, the latter will more certainly repay the industry and skill of the planter."

For the cultivation of the best cotton, there are two other requisites, besides a sandy soil, proximity to the sea, and salt clay mud as a manure:—First, very great care is necessary in the selection of the seed; and, second, there must be diligence in weeding, pruning, and in every part of the cultivation. The seed should be selected from the most perfect, early stalks, produced on the best land;* and it is indispensable frequently to change the soil and situation, in order to keep up the quality of the produce yielded by any particular kind of seed. To carelessness in the use of mixed and bad seed, the indifferent quality of cotton in many countries

* Mr. Seabrook's Report, p. 8.

is greatly owing.* It is usual to throw the seed into water before sowing it, when the bad seed will float, and the good will sink.

The celebrated Sea Island cotton is much longer in the fibre than any other description. It is also strong and even, of a silky texture, and has a yellowish tinge. Its seed is black, whereas most of the other American cotton is produced from green seed. It is of the annual herbaceous kind. This valuable plant was first sent in the winter of 1786, from the Bahama islands, (where it had been introduced from Anguilla, in the West Indies,) to Georgia, by some of the American royalist refugees, who had settled in the Bahamas at the close of the revolutionary war.† The soil and situation of the low sandy islands, which lie along the coast from Charleston to Savannah, were found extremely congenial to the plant, and from them the cotton which it produces derives its name. The great demand for cotton-wool in England, (owing to the rapid extension of the manufacture,) and the high price fetched by this particular description, induced the Americans to cultivate it with diligence. The quantity raised, however, is limited by the peculiar combination of circumstances requisite for its production, and only a very small proportion of the cotton grown in the United States is of this kind. Nor is the quantity at all on the increase. In the year 1805,

* See p. 64; also, Edwards's Hist. of the West Indies, Vol. II. p. 270; and Porter's Tropical Agriculturist, p. 11.

† Letter from Mr. Thomas Spalding, Darien, Georgia, inserted in Mr. Kennedy's "Brief Memoir of Samuel Crompton," and in Mr. G. R. Porter's "Tropical Agriculturist." Mr. Spalding, whose father was one of the first to cultivate the long-stapled cotton, in 1787, states that the seed of the Bourbon cotton, and every other kind of cotton in the world but *one*, have been tried in the United States without success. It is supposed that Persia is the native country of the Sea Island species.

the export of the Sea Island cotton was 8,787,659 lbs. and in the year ending 30th September, 1832, it was only 8,743,373 lbs. This cotton, being from the situation in which it is grown much exposed to the inclemency of the weather, varies greatly in quality, the finer sorts bringing often three times the price of the damaged sorts.

A short-stapled cotton, of inferior value, had been cultivated in the southern states of North America before the revolutionary war, and used for domestic purposes. The cultivation of this article, which is named Upland, or Bowed Georgia,* was greatly improved and enormously extended in consequence of the demand from England. It was at first chiefly raised in Georgia and South Carolina, but of late years it has spread with so much rapidity in Alabama, Mobile, and the valley of the Mississippi, that more than one-half of the whole imports into this country now come from the Gulf of Mexico; and owing to the fertility and cheapness of the new soils, the price of the article has been very greatly reduced.

The operation of gathering the ripe cotton needs to be performed with care. The women and young people, who are employed in it, go through the plantation several times, as the pods do not all open together, and the cotton should be plucked within a few days after it has opened. The cotton and seeds are plucked, leaving the husk behind. Fine weather is chosen, as any degree of wet on the cotton would make it afterwards become mouldy, and would cause the oil of the seeds to spread upon the wool. That it may be more completely dried, it is exposed to the heat of the sun, on a platform of tiles

* For an explanation of this term, see p. 67.

or wool, for several days after it is gathered: by this means not only the wool, but also the seeds become dry, in which state they are more easily separated from the wool.*

To detach the cotton from the seeds which it envelops, is a work of some difficulty, and one which must be performed effectually before the cotton is packed, otherwise it will inevitably become oily and mouldy, and by the particles of seed and dirt be rendered unfit for spinning. To do this by the hand, would be a very slow and expensive process, as a man could not clean more than a pound per day. All nations at any remove from barbarism, therefore, employ some kind of machinery. The rude hand-mill, or roller-gin, used in India, China, and throughout Asia, has been described, and shown by a drawing, at p. 66; but this also is a comparatively slow process, by which not more than from forty to sixty-five pounds in a day can be cleansed. The long-stapled, or Sea Island cotton, is still separated from the seeds by rollers, constructed on a large scale, and worked by horses, steam, or other power. A mill of this kind, which is capable of cleansing eight or nine hundred pounds of cotton in a day, is thus described:—

"It consists of two wooden rollers of about an inch in diameter; these are placed horizontally, parallel and touching each other. Over them is fixed a sort of comb, having iron teeth two inches long and seven-eighths of an inch apart. This comb is of the same length as the rollers, and so placed that its teeth come nearly in contact with them. When the machine is set in motion, the rollers are made to revolve with great rapidity, so that the cotton being laid upon them, it is by their motion drawn in between the two, whilst no space is left for the seeds to pass with it. To detach these from the fibres of cotton in which they

* Porter's Tropical Agriculturist, p. 21.

are enveloped, the same machinery which impels the rollers gives to the toothed instrument above a quick, wagging motion to and fro, by means of which the pods of cotton, as they are cast upon the rollers, are torn open, just as they are beginning to be drawn in; the seeds, now released from the coating which had encircled them, fly off like sparks to the right and left, while the cotton itself passes between the cylinders. The sharp iron teeth of the comb, moving with great velocity, sometimes break the seeds; then the minute pieces are instantly hurried on, and pass between the rollers with the cotton. These stray particles are afterwards separated by hand, a process which is called *moting*. Entirely to cleanse the cotton from any remaining fragment of seed, it is subjected to another process. This consists in whisking it about in a light wheel, through which a current of air is made to pass. As it is tossed out of this winnowing machine, it is gathered up, and conveyed to the packing house, where by means of screws it is forced into bags, each when filled weighing about three hundred pounds. These are then sewed up, and sent to the place of shipment, where they are again pressed, and reduced to half their original size."*

The short-stapled American cotton is cleansed by a very different and much more rapid process, without the invention of which that species of cotton must have been much dearer than it now is, (if indeed it could have been used at all,) and consequently the cotton manufacture itself could not have attained its present extension.† In

* Hall's Travels in North America.

† Malte Brun states, that the short-stapled American cotton adheres so closely to the seeds, that it would not have been worth cleaning if the new process had not been invented. (Vol. V. p. 193, Book 80.) This is not true of all short-stapled and green-seed cotton, as such cotton is cleaned in India and other countries with the old roller-gin. Bryan Edwards, however, in his History of the West Indies, (published in 1793,) mentions a kind of green-seed cotton grown there, "of which the wool is so firmly attached to the seed, that no method has hitherto been found of separating them, except by the hand; an operation so tedious and troublesome, that the value of the commodity is not equal to the pains that are requisite in preparing it for market; but the staple being exceedingly good, and its colour perfectly white, it would doubtless be a valuable acquisition to the muslin manufactory, could means be found of detaching it easily from the seed." He also

1793, Mr. Eli Whitney, of Westborough, in Massachusetts, invented the saw-gin, with which one man may cleanse three hundredweight of cotton in a day. The cotton is put into a receiver, or hopper, of considerable length compared with its width, one side of which is formed by a grating of strong parallel wires, about an eighth of an inch apart. Close to the hopper is a wooden roller, having upon its surface a series of circular saws, an inch and a half apart, which pass within the grating of the hopper to a certain depth. When the roller is turned, the teeth of the saws lay hold of the locks of cotton, and drag them through the wires, whilst the seeds are prevented by their size from passing through, and fall to the bottom of the receiver, where they are carried off by a spout. The cotton is afterwards swept from the saws by a revolving cylindrical brush. When first invented, the wooden cylinder was covered with teeth of wire, like cards, but the saw is found to answer the purpose better. The saw-gin injures in some degree the fibre of the cotton; but it affords so cheap a way of cleansing it, that all the North American cotton, except the Sea Island, undergoes this operation.

The skill and energy applied to the cultivation of cotton in the United States have enabled that country to distance all others in providing a supply for the manufactures of England. In 1784, an American vessel

mentions another kind of cotton, of which "the seeds are larger, and of a duller green than the former, and the wool is not of equal fineness, though much finer than the cotton-wool in general cultivation." (Vol. II. p. 269.) To which of these kinds the Upland cotton of North America belongs, I do not know: if to the former, as Malte Brun asserts, then Mr. Whitney's machine has indeed been of immense importance both to the agriculture of America and the manufactures of England, as that cotton furnishes three-fourths of all that is used in this country.

arrived at Liverpool, having on board eight bags of cotton, which were seized by the custom-house officers, under an impression that cotton was not the produce of the United States!* The extraordinary progress of the growth and export is shown by the following tables:—

Exports of Cotton from the United States.

Years.	Quantity.	Years.	Quantity.	Years.	Quantity.	Years.	Quantity.
	lbs.		lbs.		lbs.		lbs.
1791	189,316	1799	9,532.263	1807	66,212,737	1815	82,998,747
1792	138,328	1800	17,789,803	1808	12,064,366‡	1816	81,747,116
1793	487,600	1801	20.911,201	1809	53,210,225	1817	85,649,328
1794	1,601,700	1802	27,501,075	1810	93,874,201	1818	92,471,178
1795	6,276,300†	1803	41,105,623	1811	62,186.081	1819	[illegible],997,045
1796	6,106,729†	1804	38,118.041	1812	28,952.544§	1820	127,860,152
1797	3,788,429	1805	40,383,491	1813	19,399.911§		
1789	9,360,005	1806	37.491,282	1814	17,806,479§		

Parliamentary Paper, No. 578, Sess. 1828.

Years.	Sea Island.	Other kinds.	Totals.	Value.
	lbs.	lbs.	lbs.	Dollars
1821	11,344,066	113,549.339	124,893,405	20,157.481
1822	11,250,635	133,424,460	144,675,095	21,035,058
1823	12,136,688	161,586,582	173,723,270	20,445,520
1821	9,525,722	132,843,941	142,369,663	21,917,191
1825	9,655,278	166,784,629	176,139,907	36,346,649
1826	5,972,852	198,562,563	204,535,415	25,025,214
1827	15,140,798	579.169,317	294,310,115	29,359,545
1828	11,288,419	299,302,044	210,590,463	22,487,229
1829	12,833,307	252,003,879	264,847,186	26,574,311
1830	8,147,165	290,311,937	298,459,102	29,674,883
1831	8,311,762	268,668,022	270,979,784	25,2[illegible]9,492
1832	8,743,373	313,471,749	322,215,122	31,712,682
1833				36,191,102

* Smithers's Hist. of Liverpool, p. 124.

† The years 1795 and 1796 include a quantity of foreign cotton in the exports.

‡ 1808 was the year of the American embargo on foreign trade.

§ The years 1812, 1813, and 1814, were those of the American war.

The whole growth of the United States, from 1819 to 1832, was thus given in to the Commons' Committee on Manufactures, Commerce, &c. in 1833, in the form in which it is usually made up, namely, in bales:—

CROPS OF COTTON IN THE UNITED STATES.

Years.	Bales of 300 lbs.	Years.	Bales of 300 lbs.
1819	303,589	1826	937,000
1820	369,800	1827	712,000
1821	539,038	1828	857,000
1822	588,139	1829	976,845
1823	509,600	1830	1,038,847
1824	560,000	1831	950,000
1825	710,000	1832	1,050,000

The distribution of these immense exports will be shown by the following table, which also affords *some* index to the extent of the cotton manufacture in the other countries of Europe, as compared with Great Britain:—

Quantity and Value of the Exports of Cotton Wool from the United States, during the Year ended the 30th of September, 1832, specifying the Countries to which Exports were made, with the Quantities and their Values sent to each.

Whither Exported.	Sea-Island.	Other kinds of Cotton.	Value
	lbs.	lbs.	Dollars.
Russia		838,951	87,973
Sweden and Norway		699,002	75,711
Denmark		305,450	27,812
Holland		3,920,016	392,430
England	7,011,235	210,196,428	21,262,900
Scotland	319,991	10,674,157	1,088,344
Ireland		805,148	77,807
Gibraltar		492,778	42,537
British East Indies	136,140		20,420
British West Indies		376	41
British American Colonies		36,171	4,298
Hanse-Towns, &c.		4,075,122	403,099
France on the Atlantic	1,276,004	67,722,972	6,931,561
France on the Mediterranean		8,168,831	791,311
Spain on the Atlantic		1,296,474	142,924
Spain on the Mediterranean		987,401	93,491
Cuba		335,900	17,660
Italy and Malta		580,974	51,606
Trieste and other Austrian ports		1,654,775	179,402
Europe generally		380,513	33,353
Total	8,743,373	313,471,749	31,721,682

Papers laid before Congress, 15th Feb. 1833, *p.* 218.

Thus the total exportation of American cotton in the year ended 30th September, 1832, was 322,215,122 lbs. Add to this the quantity consumed that year in the American manufactures, namely, 77,757,316 lbs.;* and the total quantity grown in the United States, in the year, appears to have been 399,972,438lbs. The value must be about 40,000,000 dollars, (£8,500,000;) and in the year 1833 the value was several million dollars more than in 1832. This article alone furnishes one-half of the whole exports of United States produce. So vast a production has risen up in little more than forty years, all of which may be ascribed to the mechanical inventions of England.

In the infancy of the cotton manufacture, England obtained her supply of the raw material from the Mediterranean and Levant. In the eighteenth century, the largest supplies came from the West Indies and South America, as will be seen from the following table of the quantities of cotton imported into England from different countries, in the year 1786:—

IMPORTS OF COTTON WOOL IN 1786.

From the British West Indies	5,800,000 lbs.
. . French and Spanish Colonies	5,500,000.
. . Dutch Colonies	1,600,000
. . Portuguese Colonies	2,000,000
. . Smyrna and Turkey	5,000,000
Total	19,900,000 lbs.

* Evidence of Mr. J. Kempton, an American, before the Select Committee of the House of Commons on Manufactures, Commerce, and Shipping, 1833: Mr. Kempton stated this on the authority of a committee of Congress.

A small quantity of cotton, of the best quality then known, was received from the Isle of Bourbon by way of Ostend. It is recorded, that in the year 1786 this sold at from 7s. 6d. to 10s. per lb. In 1780, however, we are assured by Mr. Bryan Edwards, that "the finest grained and most perfectly cleaned cotton which was brought to the English market, was, he believed, that of the Dutch plantations of Berbice, Demerara, and Surinam, and of the island of Cayenne." He gives the following as the prices of several kinds of cotton in England in the year 1780:—

Berbice . .	2s. 1d. per lb.	St. Domingo	1s. 10
Demerara .	1 11 to 2s. 1d.	Tobago . .	1 9
Surinam . .	2 0	Jamaica .	1 7
Cayenne .	2 0		

In the MS. book of Mr. John Wyatt, of which an account is given at p. 126, the price of cotton is stated to be 10d. per lb., which would, however, be the inferior cotton of the West India islands.

Brazilian cotton was first imported from Maranham in the year 1781, in a very dirty state; but soon after it was found that the Pernambuco cotton exceeded even that of Demerara in fineness and goodness of staple; and it was in consequence so much sought after that its cultivation was extended, and from that time to the present the growth has on the whole increased, and it continues to fetch the highest price of all cotton except Sea Island. The supply of cotton received in this country from Brazil is considerable, and tolerably regular. The Brazilian cotton has been called *kidney*

cotton, from the seeds being of the kidney shape; they are clustered together in the pod, and adhere to each other.

All the South American and most of the West India cotton is long-stapled, and is produced from the shrub, not from the herbaceous plant. It is supposed that some of the finest cotton ever grown was in the island of Tobago, by Mr. Robley, between the years 1789 and 1792; but in consequence of a fall in the price of cotton, and a rise in the price of sugar, that gentleman discontinued the cultivation of the former for that of the latter.

About the year 1823, long-stapled cotton of an excellent quality, equal to the Pernambuco, and superior to every other kind except Sea Island, began to be imported from Egypt, where the enterprising viceroy, Mehemet Ali, cultivated the article as a speculation of his own. Cotton, as has been seen in the early part of this work, (p. 19,) was grown in Upper Egypt in the time of Pliny, but the cultivation had long since been discontinued; and it was only about the year 1821 that the Pasha, having learnt the adaptation of the soil to this plant, and having succeeded in several experimental plantations, began to cultivate cotton on the large scale in Upper Egypt. The result was extremely favourable. The first year of its cultivation only 60 bags were produced; the second year, 50,000; the third year, 120,000; and in 1824, 140,000 bags.* The imports of Egyptian cotton into this country have been as follow:—

* Madden's Travels in Turkey, Egypt, &c. vol. i. p. 245.

EGYPTIAN COTTON IMPORTED INTO GREAT BRITAIN.

Years.	Bags.	Years.	Bags.
1823 . . .	5,623	1829 . . .	24,739
1824 . . .	38,022	1830 . . .	14,752
1825 . . .	111,023	1831 . . .	38,124
1826 . . .	47,621	1832 . . .	41,183
1827 . . .	22,450	1833 . . .	3,893
1828 . . .	32,889		

The bags vary in weight in different years, from 180 to 240 lbs. In 1827 or 1828, a quantity of seed from the Sea Island cotton was planted in Egypt, and it flourishes, and yields cotton only inferior to the American Sea Island.* From the above table it will be seen that the quantity of cotton exported fluctuates greatly, and during the years 1833 and 1834 it has been very insignificant; but it may increase again as rapidly as it has declined, being in a great measure regulated by the capricious determination of the Pasha. A considerable quantity of the raw material must be consumed by the twenty-three or twenty-four large cotton spinning mills which the Pasha has erected, and filled with machinery: but this manufacturing project has so entirely failed to yield profit; that it must sooner or later be abandoned.† It is

* St. John's Travels in Egypt, vol. ii. p. 440. Encycl. Britannica.

† Mr. St. John informs us that about 12,000 men were at one time employed in the cotton mills; that the mills are worked by bullocks; and that the spinning machinery was made in Egypt by workmen under the tuition of French and Italian artisans, and with tools brought at enormous cost from England and France. That author remarks, that the atmosphere, impregnated with nitre, is destructive to the more delicate parts of the machinery, and that the fine silicious dust of that country is equally injurious. The yarn spun in these mills is extremely bad, and

proper to remark, that Egyptian cotton is more difficult to bleach than any other, and that it will not receive so bright a dye in some colours.

Indian cotton comes to this country in considerable quantities, but not very regularly, and it is the worst in the English market, owing to the negligent cultivation and packing; but it is probable that the free application of English capital and skill to the cultivation of this article, which will doubtless be made now that the restrictions on the settlement of Europeans in India are removed, will improve the quality and extend the growth of cotton in Hindoostan.

The following tables will shew in what proportions different countries supply the English manufacturers with this most important raw material:—

sells for much less by weight than the raw material itself. The management of the mills and the workmen is characterized by all the vices incident to government monopolies, and to a barbarous state of society; and it is quite obvious that the speculation must cause heavy loss, and be finally relinquished. Vol. ii. chap. 18.

IMPORTS OF COTTON WOOL FROM 1820 TO 1833.

Quantities of Cotton Wool imported, distinguishing the produce of British Possessions from that brought from Foreign Countries, together with the quantities exported and cleared for consumption, from 1820 to 1833, both inclusive.

IMPORTED FROM FOREIGN COUNTRIES.

Years.	United States of America.	Brazil.	Turkey and Egypt.	Other Foreign Countries.	Total from For. Countries.
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*
1820	89,999,174	29,198,155	285,350	2,045,147	121,527,826
1821	93,470,745	19,535,786	856,868	2,504,180	116,367,579
1822	101,031,766	21,705,206	395,077	1,534,483	127,666,532
1823	142,532,112	23,514,641	1,334,547	1,988,773	169,370,073
1824	92,187,662	24,849,552	7,719,368	1,278,720	126,035,392
1825	139,908,699	33,180,491	18,938,246	7,215,229	199,272,665
1826	130,858,203	9,871,092	10,032,400	755,153	151,516,848
1827	216,921,812	20,716,162	5,071,579	1,279,873	243,992,426
1828	151,752,289	29,143,279	6,926,288	1,579,711	189,401,567
1829	157,187,396	28,878,386	5,986,385	1,070,800	193,122,967
1830	210,885,358	33,092,072	3,401,710	639,823	248,018,963
1831	219,333,628	31,695,761	8,081,021	697,691	259,808,104
1832	219,756,753	20,109,560	9,113,890	598,048	249,578,251
1833	237,506,758	28,463,821	987,262	1,696,108	268,953,949

IMPORTED FROM BRITISH POSSESSIONS.

Years.	East Indies and Mauritius.	British West Indies.		Other British Possessions.	Total from British Possessions.
		The growth of	Foreign.		
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*
1820	23,125,825	6,219,625	617,191	182,188	30,144,829
1821	8,827,107	5,851,911	1,284,036	202,954	16,169,011
1822	1,551,225	9,031,904	1,263,210	321,757	15,171,096
1823	11,839,117	5,719,610	1,315,183	158,520	22,032,430
1824	16,120,005	5,006,002	1,263,301	655,509	23,341,820
1825	20,294,262	7,413,764	780,184	244,416	28,732,626
1826	21,187,900	4,510,302	240,768	151,583	26,090,553
1827	20,984,916	6,227,172	938,700	305,686	28,456,483
1828	32,247,187	5,893,800		218,088	38,359,075
1829	24,908,399	4,640,414		95,631	29,611,444
1830	12,483,217	3,429,247		30,025	15,942,489
1831	25,805,153	2,228,927	172,758	659,911	28,866,749
1832	35,178,625	1,708,761	331,664	35,221	37,251,274
1833	32,755,164	1,653,166	431,696	162,862	35,002,888

TOTALS.

Years.	Quantity Imported	Quantity Exported.	Quantity entered for Consumption
	lbs.	*lbs.*	*lbs.*
1820	151,672,655	6,024,038	152,829,633
1821	132,536,620	14,589,497	137,401,549
1822	142,837,628	18,269,776	143,428,127
1823	191,402,503	9,318,402	186,311,070
1824	149,380,122	13,299,505	141,038,743
1825	228,005,291	18,004,953	202,546,869
1826	177,607,401	24,474,920	162,889,012
1827	272,448,909	18,134,170	249,801,396
1828	227,760,642	17,396,776	20[illegible],987,744
1829	222,767,411	30,289,115	204,097,037
1830	263,961,452	8,534,976	259,616,610
1831	288,674,853	22,308,555	273,249,653
1832	286,832,525	18,027,940	259,412,463
1833	303,656,837	17,363,882	293,682,976

Tables of the Revenue, Population, and Commerce of the United Kingdom, prepared by the Board of Trade.

A few words must be said as to the distinguishing qualities of cotton-wool in the estimation of the manufacturer. The quality depends on the length, strength, and fineness of the fibre, or, as it is called in the trade, the staple: but these, which are the essential attributes of quality, are modified by the cleanliness and the colour. The different denominations of cotton-wool vary considerably from each other in these particulars, and the value is estimated accordingly. In cotton of the same denomination, there is also a considerable difference in quality. In Sea Island cotton, which as a class is by much the most valuable, this difference is great; the very finest quality of this class, in ordinary states of the market, is worth three times as much as

the common quality of the same class. The variation of quality in most of the other denominations is from 20 to 25 per cent., and in none of them is more than 50 per cent. Formerly, the usual distinction of the different sorts of cotton had reference to the colour, "yellow" and "white." But now, improved modes and processes of manufacturing have rendered colour of less importance than staple, and the broad distinction is therefore into "long-stapled" and "short-stapled." The principal long-stapled cottons are Sea Islands, Brazils of every kind, Demerara, West Indian, and Egyptian. The short-stapled cottons include such parts of the produce of North America as are grown in the interior of that country, and called Uplands, Orleans, Alabama, Mobile, &c., as well as the East India cotton, Surat, Bengal, and Madras. Except the better qualities of Sea Islands, there is no sort of cotton which is now confined in its use to any peculiar or exclusive purpose. By mixing different sorts together, and by careful management in preparing the mixture for the spinning, the manufacturers can now make a substitute for almost any particular kind of cotton, except the very best. It is only requisite to add, that the long-stapled cottons are generally used for the twist or warp, and the short-stapled for the weft.

The market price of the several descriptions of cotton at Liverpool, at the present time, and in April 1832 and 1833, will be seen from the following table, obtained from the "Price Current" of Messrs. Priestley, Griffith, and Cox, brokers, of Liverpool:—

PRICES OF COTTON IN LIVERPOOL.

	30th April, 1832.	30th April, 1833.	1st July, 1834.
	s. d. s. d.	s. d. s. d.	s. d. s. d.
Sea-island, stained, *per lb.*	0 6 to 0 9½	0 7 to 0 10	0 9 to 1 2½
ordinary to fair . .	0 11¼ — 0 11¼	0 11 — 1 0	1 [illegible] — 1 5
good fair to very fine .	1 0 — 1 8	1 0½ — 2 0	1 5½ — 2 0
New Orleans, very ordinary to fair . .	0 6⅛ — 0 6¾	0 5⅝ — 0 7¼	0 7¼ — 0 8½
good fair to good . .	0 6⅞ — 0 7⅜	0 7½ — 0 7⅞	0 9 — 0 9½
very good to prime .	0 7½ — 0 8¼	0 8 — 0 9	0 9¾ — 0 10½
Georgia Upland, very ordinary to fair . .	0 5¼ — 0 6⅝	0 6⅛ — 0 7⅛	0 7¼ — 0 8½
good fair to prime . .	0 6¼ — 0 7¼	0 7⅜ — 0 8	0 8⅞ — 0 9½
Alabama and Mobile .	0 5⅝ — 0 6¼	0 6½ — 0 7¼	0 7 — 0 9½
Egyptian	0 9¾ — 0 9	0 9½ — 0 10½	1 3 — 0 0
Pernambuco	0 8½ — 0 9¼	0 8⅞ — 0 10¼	0 11¼ — 1 0½
Maranham	0 7 — 0 8½	0 8¼ — 0 9¾	0 9½ — 1 0
Bahia and Maçaio . .	0 6¼ — 0 7½	0 8 — 0 9	0 9¾ — 0 11
Demerara and Berbice .	0 7½ — 0 9¾	0 8½ — 0 10	0 11 — 1 2½
Barbadoes	0 6¾ — 0 7¼	0 8 — 0 8½	0 10 — 0 10½
Bahama	0 6½ — 0 8½	0 7½ — 0 9	— — —
West India	0 6 — 0 7¼	0 7 — 0 8¼	0 9 — 0 11
Carthagena	0 5½ — 0 5⅝	0 6¼ — 0 0	0 7⅜ — 0 7½
Surat, ordin. to middling	0 4⅜ — 0 4¾	0 1½ — 0 1⅞	0 5⅞ — 0 6¼
——, fair to good . .	0 4⅞ — 0 5½	0 5¼ — 0 6¼	0 6½ — 0 7½
Bengal	0 4½ — 0 5	0 5 — 0 5½	— —

The following tables, shewing the prices of the principal descriptions of cotton from 1782 to 1834, ought to have a place in this work, as they serve to illustrate several points in the history of the manufacture. The first is taken from Mr. Tooke's work "On High and Low Prices:" it is to be regretted that it does not distinguish between the Berbice and the West India—

PRICES OF COTTON FROM 1782 TO 1805: EXCLUSIVE OF DUTY.

Years.	West India, including Surinam & Berbice.	Bowed Georgia.	Pernambuco.	Bengal and Surat.
	Per lb. s. d. s. d.	Per lb. s. d. s. d.	Per lb s. d. s. d.	Per lb. s. d. s. d.
1782	1 8 to 3 0	None.	None.	None.
	2 0 — 3 6	...	...	...
1783	1 9 — 3 0	...	...	...
	1 1 — 1 10	...	...	...
1784	1 0 — 1 10	...	...	...
	1 2 — 2 1	...	...	...
1785	1 2 — 1 10	...	...	...
	1 9 — 2 3	...	...	...
1786	1 10 — 2 2	...	...	...
	2 3 — 3 6	...	...	...
1787	1 7 — 2 9	...	...	...
	2 0 — 3 6	...	...	...
1788	1 9 — 2 9	...	2 1 to 2 7	...
	1 2 — 1 8	...	1 6 — 1 9	...
1789	1 0 — 1 7	...	1 6 — 1 8	...
	1 2 — 1 10	...	1 4 — 1 6	...
1790	1 1 — 1 8½	...	1 7 — 1 8	0 8 to 0 10
	1 0 — 1 9	...	1 8 — 1 10	
1791	1 1 — 1 9	...	1 6 — 1 8½	0 8 — 0 9½
	1 9 — 2 6	...	2 5 — 2 7	1 2 — 1 3
1792	1 8 — 2 0	...	2 5 — 2 6	1 2 — 1 3
	1 9 — 2 6	...	1 10 — 2 0	0 11 — 1 0
1793	1 0 — 2 0	1 8 to 1 10	2 1 — 2 3	1 3 — 1 4
	1 8 — 2 3	1 1 — 1 4	1 9 — 2 0	0 10 — 0 11
1794	1 1 — 1 10	1 0 — 1 3	1 11 — 2 1	0 10 — 0 11
	1 2 — 2 3	1 3 — 1 6	1 6 — 1 8	0 9 — 0 11
1795	1 3 — 1 11	1 3 — 1 6	1 9 — 1 11	0 11 — 1 1
	1 9 — 2 6	1 9 — 2 3	2 3 — 2 6	1 5 — 1 10
1796	1 9 — 2 6	1 8 — 2 5	2 3 — 2 6	1 7 — 1 10
	1 7 — 2 4	1 0 — 2 3	1 10 — 2 1	0 11 — 1 5
1797	1 5 — 2 6	1 0 — 2 3	1 11 — 2 2	0 10 — 1 5
	2 2 — 3 4	2 1 — 3 1	3 2 — 3 5	1 8 — 1 11
1798	2 1 — 3 4	1 10 — 3 0	3 2 — 3 4	1 8 — 1 11
	2 6 — 3 4	2 5 — 3 9	3 1 — 3 5	2 0 — 2 2
1799	1 6 — 2 6	3 6 — 5 0	4 2 — 4 8	2 2 — 2 4
	3 4 — 4 7	1 5 — 2 8	2 5 — 2 8	0 11 — 1 2
1800	1 8 — 2 9	1 6 — 3 0	2 9 — 3 0	0 10 — 1 4
	2 3 — 3 2	1 4 — 2 10	2 11 — 3 1	1 3 — 1 6
1801	2 1 — 3 0	1 6 — 3 2	2 9 — 2 11	1 5 — 1 6
	1 9 — 2 8	1 5 — 2 11	2 8 — 3 0	1 2 — 1 5
1802	1 9 — 2 9	1 5 — 3 0	2 8 — 2 11	1 3 — 1 6
	1 3 — 2 1	0 10 — 2 8	2 0 — 2 5	0 10 — 1 2
1803	1 4 — 2 2	1 1 — 1 3	2 0 — 2 4	0 10 — 1 2
	1 2 — 2 3	0 8 — 1 0	2 2 — 2 5	0 9 — 1 2
1804	1 0 — 2 1	0 10 — 1 0	1 9 — 2 0	0 8 — 0 10
	1 6 — 2 4	1 4 — 1 6	2 3 — 2 6	0 10 — 1 3
1805	1 6 — 2 4	1 5 — 1 7	2 3 — 2 6	1 0 — 1 3
	1 5 — 2 0	1 2 — 1 4	1 11 — 2 0	1 2 — 1 5

The following is taken from the "Statement of the Quotations of Cotton Wool in Liverpool," published at the close of the year 1833, by Messrs. George Holt & Co. brokers, of that place:—

Statement of the Extreme Prices of Cotton Wool in each Year, from 1806 to 1833.

	1806 Good	1807 Good	1808 Good	1809 Good	1810. Good	1811 Good	1812 Good	1813 Good	1814 Good	1815. Good	1816	1817.
	d d.	d d	d d	d d	d d	d d	d d.	d d	d d	d d	d d d d.	d d d d
Upland	15 21½	15½ 19	15½ 30	14 34	14½ 22½	12¾ 16	13 23½	21 30	23 37	18 25½	15 a 17 19½ a 21	16½ a 20 19¾ a 23½
New Orleans	17 24	18 21	17¼ 37	17 36	10½ 23½	13½ 17½	14 26	23 31	29 39	21 31	15 19½ 20 24	18 20 23 25½
Sea Island	30 37	28 30	28 58	28 59	20 33	22 30	25 40	37 48	42 72	33 57	[illegible] 28½ 20 39	22 30 25 30
Pernambuco	23½ 29	24½ 26½	25½ 42	22½ 38	23 29	18 23½	19 27½	24 34	28½ 41	25½ 37	23 24 29 30	22 24 26¾ 27¾
Maranham	21½ 26	22½ 24½	22 38	19½ 36	20 27	14¾ 20½	16 26	22 33	26½ 39	23½ 33	22 22½ 27½ 28	22 23 25½ 26
Surat	— 17	— —	14 25½	11 26	12½ 19	10½ 11	12 16	15½ 20	18 25	14½ 21	14 15 17 18½	14½ 17½ 16 20
Demerara	22 26½	22 24	23 40	20 40	21½ 28	17 21½	17¾ 27½	24 33	27½ 39½	24 30	20 23½ 26 29½	19 23½ 23 26½

	1818	1819	1820	1821	1822	1823	1824.	1825
	d d d d	d d d d	d d d d	d d d d	d d d d	d d d d	d d d d	d. d d d.
Upland	16½ a 19½ 20½ a 22	10 a 12½ 17 a 19½	8 a 11 12½ a 13¾	7 a 10 9½ a 11½	5¾ a 6¼ 7¾ a 11	6¼ a 8½ 8½ a 10¾	7 a 8¾ 9 a 10½	6 a 9½ 16¾ a 19½
New Orleans	10½ 20½ 21 25	10½ 15½ 10½ 21	8½ 11 12½ 17	7¾ 12½ 9 14	6 10½ 8½ 12½	7 11 8¾ 13	7½ 11 9 13	8 12 17½ 22
Sea Island	25 36 33 54	21 30 29 46	15 28 22 36	12½ 26 14 30	10 24 12½ 28	11¼ 22 13 24	11½ 22 15 27	15 27 33 42
Pernambuco	22 23 26 27	16 18 22½ 25½	11½ 13 17 18½	11½ 12½ 13½ 14½	9½ 10½ 11½ 12½	10½ 11½ 13 14½	10 11¾ 11¾ 13	11½ 12½ 22½ 23½
Maranham	20 20½ 21½ —	15 16 20½ 21	11 11¾ 16 16½	10½ 11½ 12½ 13½	8½ 9½ 10½ 11½	9½ 10½ 12½ 13½	9½ 10¾ 10¾ 11⅞	10¾ 11¼ 21½ 22¾
Egyptian	— —	— —	— —	— —	— —	— —	9½ 11 11 12¾	10¾ 12 21 24
Surat	7 14 15½ 20½	5¾ 10½ 8½ 14½	6¾ 9½ 7½ 12	6½ 8½ 7 9¾	5½ 7¼ 6½ 8½	5¼ 7¼ 6½ 8½	5⅝ 7 5⅝ 8	5⅝ 7¾ 12 16
Demerara	19 24 25 30	12¾ 18 19 24	11 14 14 19	9 13 11 14	7¾ 10½ 9½ 13	8½ 11½ 12 14	10 12 10 13	10 12½ 19 24

	1826	1827	1828	1829	1830	1831	1832.	1833
	d d d d	d d d d	d d d d	d d d d	d d d d	d d d d	d d d d	d d d d
Upland	5¼ a 6¼ 6 a 8¾	4⅞ a 6¾ 6¼ a 7¾	5 a 6¾ 6⅛ a 7⅝	4⅝ a 6½ 5¾ a 7	5 a 7 6¼ a 7⅞	4¾ a 6⅞ 5¾ a 7¼	5 a 7 6⅝ a 8	6½ a 7⅞ 9¾ a 12¼
New Orleans	5¾ 8 7 11½	5½ 8¾ 7 9½	5½ 8 6¼ 9	4¾ 7½ 6 9	5⅞ 8 [illegible] [illegible]	5 7½ 6¼ 8	5½ 8 6¾ 9	6½ 9 9⅞ 14
Sea Island	10 20 17 30	9¾ 18 11½ 20	10 18 12½ 22	9 18 12 21	11¼ 20 [illegible] [illegible]	[illegible] 18 10¾ 18	9½ 18 11 18	10½ 18 14 22
Pernambuco	9½ 10¾ 11 12	8 9 10 11	7½ 8½ 8¼ 9½	6⅞ 7½ 7½ 8½	7½ 8 [illegible] 9½	[illegible] 8½ 7⅞ [illegible]	7⅞ 8¾ 9¼ 10½	8½ 9¾ 12¼ 14½
Maranham	8½ 9½ 10 10¾	7½ 8 8¾ 9¾	7¼ 7¾ 7⅞ 8¼	5⅝ 6½ 7¼ 7¾	6 7 7⅞ 8⅞	6⅝ 7⅛ 7 7¾	6 7⅞ 8 9⅞	7⅝ 9⅝ 11½ 13⅝
Egyptian	6½ 8½ 9½ 11	6½ 8 7 8½	6¾ 8½ 7¼ 9	5⅞ 7½ 7 8½	6½ 8¼ 8½ [illegible]	7 [illegible] 8 9¼	7 9 8½ 9½	— —
Surat	4½ 6 5½ 7	3⅞ 5½ [illegible] [illegible]	3½ 5 3⅞ 5½	2⅞ 4½ 3½ 5½	[illegible] 5¼ 4½ 6	3½ 4¾ 4½ 5¾	3½ 4¾ 4⅞ 5½	4½ 6½ 7 8¼
Demerara	7½ 10½ 9⅛ 12¾	6¾ 9¾ 6 11	6¾ 9 6¾ 9½	5¼ 8 6¾ 9	5¼ 8 7 10	6 9 6½ 10	6 9½ 7 10	7½ 10½ 10½ 13

The following table, from the same source as the last, contains so many interesting particulars, which at a glance convey much of the history of the Cotton Trade for the last eighteen years, that it could not with propriety be omitted:—

SUMMARY STATEMENT

OF THE

Consumption, Export, Import, &c. of COTTON-WOOL IN GREAT BRITAIN, *from the Year* 1816; *in Packages.*

	1816.	1817	1818	1819	1820	1821	1822	1823	1824.	1825.	1826.	1827.	1828.	1829.	1830.	1831.	1832.	1833.
Average Weekly Consumption—Upland	—	—	2 179	2 380	2 918	3 292	3 839	3,890	4 212	3 713	3,783	4,241	4,990	5,304	5,452	5,241	6,219	5,421
Orleans and Alabama....	990	669	875	1 284	1,192	1 589	1,552	2,169	2,298	2,442	2,713	3,940	4,210	3,788	4,756	5,800	5,321	6,442
Sea Island....	—	—	289	329	409	604	652	629	754	360	369	673	635	539	460	517	519	665
Total American ..	4,036	3,509	3,343	3 993	4 519	5,285	6,043	6,688	7,264	6 515	6,865	8 854	9,835	9,631	10 668	11,558	12,059	12,528
Brazil............... ...	1,589	2,075	2 459	2,456	2,408	2 509	2,646	2,577	2,890	2,502	1,188	1,815	2,456	3,094	3,602	3,294	2,843	2,683
Egyptian, &c.	—	—	—	—	—	—	—	—	362	891	975	1,142	671	485	508	619	881	279
East India...............	207	1 192	1,581	1,190	1,518	1,619	953	852	644	1 096	489	664	738	658	940	765	1,161	1,210
Demerara, West India, &c	656	1,050	746	713	534	785	835	654	473	527	308	502	380	463	284	260	196	223
Total..........	6 488	7,826	8,129	8 352	8,979	9,598	10 477	10 771	11 633	11,531	9 825	12,977	14 080	14 331	16,002	16,496	17,140	16,923
Taken for Consum. in Eng. from Liverpool	5,254	5 838	6,379	6,815	7,627	7,559	8,027	8,556	10,631	9 017	9,400	11,871	12,944	12,516	13,548	14,749	14,573	15,040
Ditto do. London..	565	1 229	956	337	746	802	761	640	555	802	306	479	411	213	440	381	373	208
Ditto do. in Scotland	763	915	908	965	973	1 025	1,066	1,056	1,002	1,096	1,081	1,396	1 425	1 602	1,533	1,654	1,713	1,675
Packages sold to Speculators in Liverpool	28 700	33 700	24 600	46 800	30,000	32,000	23 000	160 000	81 000	458,000	71 000	67,000	96,000	41,500	65 000	35,500	90,600	268,000
Packages Consumed	337,400	407,000	422,700	434,300	460,900	499,100	544,800	560 100	604 900	599,600	510,900	674,800	732,200	745,200	832,100	857,800	891,300	880,000
Average Weight of Packages Consumed..	263	263	260	252	258	258	207	275	273	278	294	297	297	294	298	306	311	326
Weekly Consump in Packages av 320lbs.	5,233	6,314	6,483	6 459	7,094	7,611	8,582	9,001	9,743	9 841	8 861	11,036	12,851	12,927	14,027	15,483	16 351	16,923
Average Weight of Import	256	260	263	264	249	202	267	281	266	270	295	303	293	297	310	310	319	327
Packages Exported	29,300	26 700	55,500	66,800	28,400	52,600	59,300	35 400	53 000	72,800	95 000	69,100	63 700	118,100	33,400	74 600	67,100	67,800
Lbs Wt Imported, in Millions and Tenths	93,0	124 9	177,3	149,7	143 9	129 0	142,2	188 1	143 7	222 4	171,5	271 1	219 8	221,8	261 2	280,5	287,8	304,2
Lbs. Weight Consumed do ..	88,7	107	109 9	109,5	150 3	129,0	145,5	154 1	165,2	166 8	150 2	197 2	217 0	219 2	247,6	262,7	270,9	287
Lbs Weight in Ports 31st Dec do ..	19,2	28,9	78 2	99,5	110 5	101 7	79 4	109 6	64 0	107 0	89,0	129 2	112 7	60 8	91 4	81,3	76,5	66 9
Lbs. Weight in Great Britain, do ..	—	—	93 5	111 8	127,0	113 9	93,7	117,3	80 3	115 5	110 9	104 8	147 0	115 5	118 8	114 4	103,7	94,4
Lbs Wt. of *Yarn* exported do ..	—	—	10,1	16,7	23 9	23,2	28,0	27,4	33 6	32,6	42 2	44 9	50 5	57,3	64 7	58 8	71 7	67,7
Average quotation of Uplands in Liverpool	18¾d	20¼d	20d	13¼d	11¼d	9½d	8¼d	8½d	8¼d	11⅝d	6⅜d	6¼d	6⅜d	5⅜d	6⅞d	6d	6⅛d	8¼d.
Ditto Pernams do	20d	25d	25d	18⅜d	15½d	12⅜d	11⅛d	12d	11⅝d	15¼d	10½d	9⅜d	8⅜d	7¼d	8¼d.	7¼d	9d.	10⅝d.
Ditto Surats do	15⅝d	17d	15¾d	9⅜d	8½d	7⅞d	6⅞d	6¾d	6⅛d	8⅞d	5½d	5⅜d	4⅝d	4d	5d	4⅜d	5d.	6⅛d.

The above tables shew an extraordinary fall in the price of cotton-wool of every description between 1816 and 1833. Upland cotton, otherwise called Bowed Georgia, which is considered as forming a standard by which the value of the other kinds is measured, fell from an average of 20d. per lb. in 1818, to 8½d. in 1833. One cause of this decline in price is the increase in the value of money in England; but the principal cause is the extended growth in America, and the cheapness and fertility of the lands newly brought under cotton cultivation in the western states. The weekly consumption of Orleans and Alabama cotton in this country increased from 875 packages in 1818, to 6,442 packages in 1833; which is an increase of more than *seven-fold;* whilst in the same time the consumption of Upland cotton only increased *two and a half fold.* The quantity of cotton imported from the western states, through the ports of the Gulf of Mexico, is now greater than that from the Atlantic states; and as the planters of the Mississippi and Alabama can afford to grow cotton at the present prices, all other descriptions of cotton necessarily fall to the same level, in proportion to their quality.* The growing cheapness

* Mr. Joshua Bates, of the house of Baring, Brothers, and Co., stated, in his evidence before the Select Committee of the House of Commons on Trade, Manufactures, and Shipping, in 1833, that "it was understood that even 6 cents, or 3d. a lb. was a price at which the cotton planters could gain money in the valley of the Mississippi." Mr. Kirkman Finlay stated before the same Committee, that "the lowering of the price of cotton in America is much owing to its greatly extended cultivation in the new western states, where it has increased very much more than in the eastern." Mr. Gabriel Shaw, of the house of Thomas Wilson and Co., London, said—"The cultivation of cotton is increasing, and therefore I suppose it affords the growers a remuneration for the capital and time employed."

of the raw material must have been a principal cause of the extension of the manufacture in England since the peace, though improvements in our machinery have been another powerful cause.

Thus do mechanical improvements in England, and agricultural improvements in America, act and re-act upon each other: thus do distant nations become mutually dependent, and contribute to each other's wealth. The spinning machinery in England gave birth to the cotton cultivation in America; and the increase of the latter is now in turn extending the application of the former. In the vast machine of commerce, the spindles of Manchester are as necessarily tied to the plough and hoe of the Mississippi, as to their own bobbins. They must move or stop, be accelerated or retarded, together. The American government cannot wage war against English manufactures, without waging it equally against the southern states of its own confederation. The English government could not obstruct the trade and navigation of America, without stopping its own mills and looms.

Cotton is brought from New Orleans and Mobile to to England for ⅝d. per lb., and from the Atlantic States for ½d. to ⅝d. per lb.* The American growers frequently consign it to this country for sale on their own account, but about three-fourths of the whole quantity sent is consigned by mercantile houses.† The chief market for cotton in this country is Liverpool, as may be seen from the following account of the imports:—

* Evidence of Mr. Kirkman Finlay.

† Evidence of Mr. Gabriel Shaw.

		Bags.
In 1833, the cotton imported	into Liverpool was	840,953
. . . . .	into London . .	40,350
. . . . .	into Glasgow . .	48,913
	Total	930,216

The stock of cotton held in the ports has for some years been diminishing, as appears from the following table:—

The whole stock held in the ports of the kingdom at the close of 1833 was, of—

American	117,650
Brazil	49,250
West India	2,860
East India	44,430
Egyptian	960
1833—Total . . .	215,150 bags

The stock at the close of	1832 was . . .	245,120
	1831 . . .	274,800
	1830 . . .	320,218
	1829 . . .	289,380
	1828 . .	405,886
	1827 . . .	452,240
	1826 . . .	342,200

Cotton is sold in Liverpool by brokers, who are employed by the importers, and who charge 10s. per £100 for their trouble in valuing and selling it. The buyers, who are the Manchester cotton dealers, and the spinners all over the country, also employ brokers, at the same rate of commission, to make their purchases. The cotton is principally bought and sold by sample,—

the purchasers very rarely considering it necessary to examine the bulk. By the strict probity and honour invariably observed by the brokers in their dealings with each other, this immense business is conducted with a facility and despatch which have probably no parallel in any other market of the world, and which could not exist to the same extent in the sale of any other description of merchandise. It may be mentioned, as a proof both of the excellence of the arrangements for carrying on the business, and of the integrity of the parties engaged in it, that, though the sales are not made with the formalities necessary to render the bargains legally binding, a dispute or difficulty in their fulfilment is almost unknown. Whatever misunderstandings arise are at once settled by a reference to some of the brokers not interested in the transaction; and such is the good feeling which prevails amongst them, that on these occasions the decision is, with scarcely an exception, prompt and satisfactory. The credit allowed with the goods is ten days, and the payment is then in bills at three months; but from the present low rate of discount, when bills are cashed by the banks at 3½ per cent., the buyers almost invariably accept the alternative offered them, by paying the cash immediately, and deducting interest at the rate of 5 per cent.

CHAPTER XIV.

COMMERCIAL HISTORY.

The Cotton Manufacture owes nothing to legislative protection.—View of the different kinds of legislative interference; 1st. Restrictions on the importation of foreign cottons; 2d. Duties on cotton-wool; 3d. Excise duties on printed goods; 4th. Miscellaneous laws intended to benefit the manufacture.—The various statutes quoted.—Clamour against the admission of Indian cottons, in 1787.—High duties afterwards imposed; reduced in 1826.—Insignificant importation of foreign cottons.—Entire repeal of the duty recommended.—Improvements in the cotton manufacture by Mr. John Wilson, of Ainsworth.—Introduction of the manufacture of British calicoes and muslins.—Change in the dress of the people.—Radcliffe's description of the growth of the manufacture.—The Lace manufacture; its extent and value.—The Stocking manufacture; its extent and value.—Sewing thread.—Tables of the Imports of Cotton Wool, and of the Exports of British Cotton Goods, from 1697 to 1833.—Explanation of the apparent decline in the value of the exports.—Reduction in the price of the raw material; mechanical improvements; rise in the value of money.—Mr. Kennedy's table of comparative cost of English and Indian yarn in 1812 and 1830.—Tables of prices of warp, weft, cotton-wool, and calico, from 1814 to 1833: of prices of cotton yarn from 1786 to 1833.—Great national advantage from the cheapness of clothing.—Fluctuations in the manufacture: Mr. Kirkman Finlay's testimony concerning them, and on the present state of the trade.—Effect of the cotton manufacture in multiplying the population of Lancashire, &c.—Amazing effects of Machinery.—Comparison between the periods of 1760 and 1833.

The commercial history of the English cotton manufacture was begun in our seventh chapter, and brought down to the year 1764, (p. 84 to 112.) It was then interrupted, to describe the great mechanical inventions in cotton spinning, which changed the whole aspect of the trade. The series of inventions and discoveries in the spinning, weaving, bleaching, and printing has been so rapid and continuous, as scarcely to admit of carrying on the commercial history along with the mechanical. Yet a notice of the prodigious effects produced by the

machines of Hargreaves, Arkwright, and Crompton closed our tenth chapter; and brought us down to the year 1787, and in part to 1800, (p. 214 to 219.) Other notices of the growing magnitude of the trade naturally interwove themselves with the account of the improvements in bleaching and printing: and the commercial history of the raw material, cotton-wool, has been completed to the present time in the last chapter.

There remain to be mentioned many interesting facts connected with the growth of the manufacture and trade; among which are, the legislative interferences in the way of protection and taxation,—the change produced in the dress of the people,—the new branches of manufacture arising out of the cotton,—the increase in the amount of exports,—and the great fall produced in the price of cotton goods by machinery.

Statutes framed for the regulation of commerce have done little or nothing, either for or against the British Cotton Manufacture. This trade was not the nursling of government protection. The advocates of commercial restrictions find no support for their principles from the history of the cotton trade, however they may seem to be favoured by that of the woollen trade. Nor, indeed, does the latter furnish them with any solid argument; for although the statute-book contains an almost countless array of Acts intended to protect, to foster, to force, to regulate, and to improve the woollen manufacture, from the Third Edward down to the Third George, yet these were like so many props to the mountain pine, or crutches to the well-formed youth; they served to encumber, not to help it; and the real supports of that manufacture were the copious supply of wool, the only raw material of clothing furnished by this island,—

abundance of water, fuel, wood, and iron, for carrying on the processes or making the implements of manufactures,—the security for person and property afforded by the laws of England to foreigners as well as to natives,—and the wants of a numerous population, in a climate requiring warm clothing.

The woollen manufacture had become extensive and flourishing in England, long before the manufacture of cotton was introduced. When the latter was brought into this country, it had to compete with the woollen, the linen, and the silk manufactures, already well established; and from this circumstance, as well as from the scanty supply of the raw material, and, above all, from the imperfection of our machinery, its progress at first was slow, and it received no attention whatever from parliament. The English cotton manufacturers looked upon the delicate and elegant fabrics of India, hopeless of imitating them; nor would it have been possible for the English workman, feeding on meat, beer, and wheaten bread, ever to compete with the Hindoo weaver, supported by rice and pulse, spreading his web in the very field which grows the raw material, and possessing a patience and a physical organization peculiarly adapted for the manufacture of calicoes and muslins, unless the former had called the wondrous powers of mechanism to his aid.

Until the invention of the spinning machines, therefore, the English cotton manufacture was nearly confined to heavy articles, like fustians, velvets, and thicksets, of which the warp was linen, and to the small wares required for the trimmings of furniture and garments. If the manufacturers were protected from foreign competition, little benefit resulted from this protection, as the trade

extended very slowly. At the beginning of the last century, the legislature frequently prohibited the use of Indian calicoes and silks; but this was for the protection of the silk and woollen manufactures of England, not of the cotton, as no such articles were then made in this country. The English were then as incapable of rivaling the Indians in the manufacture of calicoes and muslins, as they were of competing with the Chinese in the growth of tea. The invention of the spinning machinery at once reversed the case, and placed our countrymen as much above Eastern competition as they had formerly been below it. In the early period of the trade, no legislation could have aided the English manufacture; in its latter period, legislation could scarcely have checked it. There was as great a difference in the same manufacture, before and after the inventions, as between the dwarf cotton of Timbuctoo and the stately *bombax* of Guinea. The interference of government could neither have trained up the herb into a forest tree; nor have confined the forest tree to the dimensions of an herb.

The interferences of the legislature may be classed under four heads:—

1. Restrictions, absolute or partial, on the importation of foreign cotton goods.

2. Duties on the importation of the raw material, cotton-wool.

3. Excise duties on printed goods.

4. Miscellaneous laws intended to benefit the manufacture.

1. Restrictions, absolute or partial, on the importation of foreign cotton goods. I present them in chronological order:—

1700. The Act, 11 & 12 Wm. III. c. 10, prohibited the importation of the printed calicoes of India, Persia, and China.

1721. 7 Geo. I. c. 7, prohibited the use or wear of printed calicoes, whether printed in England or elsewhere.

1783. 23 Geo. III. c. 74, reduced the heavy duties on muslins, calicoes, and nankeen cloths, to 18 per cent. ad valorem, with a drawback of 10 per cent. on exportation.

1787. 27 Geo. III. c. 13, established the following duties. On—

Plain white dimity, imported by the East India Company, 1s. 6d. per yard, and £16. 10s. per cent. ad valorem; with a drawback of nearly the amount, on exportation.

Plain white calicoes, imported by the East India Company, 5s. 3d. per piece, (a piece being ten yards long when not more than 1¼ yard wide, and six yards long when above that width,) and also £16. 10s. per cent. ad valorem; with a drawback of nearly the amount, on exportation.

Plain muslins, nankeen cloth, muslins or white calicoes flowered or stitched, imported by the East India Company, 18 per cent. ad valorem; with a drawback of 10 per cent. on exportation.

Cotton manufactures not enumerated or described, imported by the East India Company, 50 per cent. ad valorem.

Cotton manufactures not enumerated or described, imported otherwise than by the Company, 44 per cent. ad valorem; with a drawback of £41. 10s. per cent. on exportation.

The following is a statement of the duties, imposed at different times, from 1787 to the present day, furnished to me by order of the President of the Board of Trade:—

RATES OF DUTY ON COTTON GOODS IMPORTED.

	East India White Calicoes.						East India Muslins and Nankeens.			East India Dyed Goods.
	Per Piece.			*Pr. Ct. ad val.*			*Per Cent. ad valorem.*			
	s.	d.		£.	s.	d.	£.	s.	d.	
1787	5	3	and	16	10	0	18	0	0	Prohibited.
1797	5	9	and	18	3	0	19	16	0	
1798	5	9	and	21	3	0	22	16	0	
1799	6	8	and	26	9	1	30	3	9	
1802	6	8	and	27	1	1	30	15	9	
1803				59	1	3	30	18	9	
1804				65	12	6	34	7	6	
1805				66	18	9	35	1	3	
1806				71	6	3	37	7	1	
1809				71	13	4	37	6	8	
1813				85	2	1	44	6	8	
1814				67	10	1	37	10	0	

N.B. The importations of Cotton Goods, from other places than the East Indies, were inconsiderable until 1825.

COTTON MANUFACTURES OF ALL SORTS, NOT MADE UP.

1825. £10 per cent. ad valorem, and an additional duty of 3½d. per square yard, if printed.

1832. Repeal of the additional duty of 3½d. per square yard on printed cottons.

(Signed) Wm. Irving.

Inspector General's Office, Custom House, London, January 21, 1834.

2. Duties on the importation of the raw material, cotton-wool—

1766. The Act 6 Geo. III. c. 52, exempted cotton-wool from duty, on importation into, or exportation from, any British colony, and on importation into Great Britain in British-built ships. In foreign ships it was subject to a duty.

1780. 20 Geo. III. c. 45, allowed the importation of cotton in foreign ships, at a duty of 1¼d. per lb. and 5 per cent. additional—the produce to be devoted to "the encouragement of the growth of cotton in his Majesty's Leeward Islands, and for encouraging the importation thereof into Great Britain."

1787. 27 Geo. III. c. 13, allowed importation of cotton from British plantations duty free; and of cotton not from British plantations, at a duty of 1d. per lb. in foreign ships; free in British ships.

The following statement of the duties imposed on the raw material, from 1798 to the present time, has been furnished, like that just given, from the office of the Inspector General of Customs:—

RATES OF DUTY ON COTTON WOOL IMPORTED.

Previous to 1798	. . . .	Free.
1798.	Imported by the East India Company . .	4l. per cent. ad val.
	Of the British colonies or plantations . .	8s. 9d. per 100 lbs.
	Of Turkey and the United States . . .	6s. 6d. per do.
	Of any other place	12s. 6d. per do.
1801.	. . . .	Free.
1802.	Imported by the East India Company . .	4l. 16s. per cent. ad val.
	Of Turkey and the United States . .	7s. 10d. per 100 lbs.

1802.	Of the British colonies or plantations	10s. 6d. per 100 lbs.
	Of any other place	15s. per do.
1803.	Of the East Indies, Turkey, United States, and any British colony or plantation	16s. 8d. per do.
	Of any other place	1l. 5s. per do.
1805.	Of the East Indies, Turkey, United States, and any British colony or plantation	16s. 10½d. per do.
	Of any other place	1l. 5s. 8¾d. per do.
1809.	All sort	16s. 11d. per do.
1815.	All sorts	8s. 7d. per do.
1819.	Of any British colony or plantation in America, and imported directly from thence	6s. 3d. per do.
	Otherwise imported	8s. 7d. per do.
1820.	Of any British colony or plantation in America, and imported directly from thence	6s. 3d. per do.
	Otherwise imported	6l. per cent. ad val.
1821.	Of any British colony or plantation in America, and of Malta, and imported directly from thence	Free.
	Otherwise imported	6l. per cent. ad val.
1828.	Imported from any British possession	4d. per cwt.
	——— any other place	6l. per cent. ad val.
1831.	The produce of, and imported from, any British possession	4d. per cwt.
	Of any foreign country, or imported therefrom	5s. 10d. per cwt.
1833.	The produce of, and imported from, any British possession	4d. per cwt.
	Of any foreign country, or imported therefrom	2s. 11d. per cwt.

(Signed) Wm. Irving.

Inspector General's Office, Custom House, London, January 21, 1834.

3. Excise duties on printed goods. Of these an account has been given in the last Chapter, (pp. 259, 260, and 279-283.) In order to bring all the instances of legislative interference into one view, the following statement, resting (like the preceding) on the authority of the Inspector General of Customs, is subjoined :—

EXCISE DUTIES ON PRINTED COTTON GOODS.

	Per Yard.
Duties commenced 20 July, 1712.	
Calicoes printed, stained, painted, or dyed .	3d. yard wide.
From 2d August, 1714, additional duty of the like amount . . . . Total	6d. do.
17th August, 1774. Stuffs wholly made of cotton spun in Great Britain, called "British Manufactory"	3d. per yard.
5th April, 1779. 5 per cent. additional on the former duty.	
5th April, 1782. A second 5 per cent. as before.	
25th July, 1782. A third 5 per cent. as before.	
1st Oct. 1784. Duties on cotton stuffs, and cotton and linen mixed, bleached or dyed: not being linen gauzes sprigged with cotton, viz.	
Under 3s. per yard in value	1d. per yd. & 15 per cent. thereon.
At 3s. do. or upwards	2d. do. do.
1st Aug. 1785. The above [last mentioned] repealed, and new duties, viz.	
Mixed or cotton stuffs:—	d.
Of greater value than 1s. 8d. & not more than 3s.	2¼ $\frac{2}{10}$ per yard.
do. 2s. 6d.	3¼ $\frac{8}{10}$ do.
British muslins:—	
Of greater value than 1s. 8d. & not more than 3s.	2¼ $\frac{2}{10}$ do.
do. 3s.	4½ $\frac{4}{10}$ do.
10th May, 1787. The whole of the above repealed, and new duties in lieu thereof, viz.	
British Manufactory and British muslins . .	3½ per square yard.

These rates continued until the repeal of the duty, March 1, 1831.

4. Miscellaneous laws intended to benefit the manufacture. Of these the principal are as follow:—

1783. The Act 23 Geo. III. c. 21, gave bounties on the exportation of British printed cottons, viz.

Under the value of 5d per yard (before printing) .	½d. per yard.
Of the value of 5d. and under 6d. per yard . .	1d. per do.
———— 6d. and under 8d. ——— . .	1½d. per do.

Besides the drawback of the excise duty.

These bounties were continued for more than thirty years, when they were found to be so perfectly useless, that they were repealed, under the financial administration of Mr. Vansittart, without opposition.

1783. The Act 23 Geo. III. c. 77, gave the manufacturers of cotton and flax a drawback of the excise duties on hard and soft soap, amounting to ¾d. per lb. weight, and on starch, amounting to 1½d. per lb.; which indulgence has been continued to the present time.

1787. The Act 27 Geo. III. c. 28, gave calico-printers a copyright in their original patterns, so that no person could copy or prepare to copy them within two months after their first publication. This copyright was afterwards extended to three months, and continued till the present time.

1782. The 22 Geo. III. c. 40, made the destruction of cotton, woollen, silk, and linen goods, or any tools or utensils used in spinning, preparing, or weaving such goods, in England, a capital felony. This law, which was meant to check the riotous attacks on machinery, was extended, in 1789, to Scotland.

An examination of the laws above cited, and of the history of the manufacture, will make it evident that the extension of the manufacture was in no degree owing to the interposition of parliament.

At one of those periods which occur frequently in every considerable trade, when over-production causes a glut in the market, namely, in 1787, the manufacturers of muslins and calicoes took the alarm, owing to an uncommonly large accumulation of those kinds of goods in the warehouses of the East India Company, imported from India. They sent a memorial to the Board of Trade, stating that the British manufacturers were likely to be ruined by this immense importation of Indian goods, the prices of which were much reduced by the glut, and praying that restrictions might be placed on the Company's sales. A most satisfactory answer was given by the Company, in which they shewed, that the restrictions prayed for would only encourage smuggling, and throw the trade into the hands of foreigners. They also stated, that "17-20ths of the whole of the calicoes imported were exported, and that 12-20ths of the whole of the muslins were exported." "Stained and printed goods," they added, "seem to furnish a wide field for the ingenuity and industry of the British manufacturers, as the Company cannot import any goods under those descriptions for home consumption." Government, being convinced by these statements, declined to interfere; and ultimately the glut in the market proved beneficial to the manufacturers, as "it called into employment a vast number of hawkers of muslins, &c. who, by dint of low prices, diffused a taste for those goods in the remotest villages of the kingdom."*

In spite of experience, and without the slightest necessity, parliament afterwards gradually raised the duties on the import of foreign cottons till they reached the extravagant rate of £75 per cent., ad valorem, on

* Macpherson's Annals of Commerce, Vol. IV, p. 134.

printed cottons, and £67. 10s. and £50 per cent. on other kinds; and at this rate we find the duties, when Mr. Huskisson induced the legislature, in 1825, to make an approach towards free trade, and to lower the duties on foreign cottons to 10 per cent. ad valorem. The reduction of the duty had no effect in increasing the importation of foreign cottons; on the contrary, the importation has been regularly diminishing from that time to the present, as appears from the following tables:—

FOREIGN COTTON GOODS IMPORTED FROM 1826 TO 1831.

Years.	Value.	Years.	Value.	Years.	Value.
1826	£110,365	1828	£68,528	1830	£42,277
1827	115,026	1829	60,770	1831	35,180

Parl. Papers, No. 462, Sess. 1832.

FOREIGN COTTON GOODS IMPORTED INTO, EXPORTED FROM, AND CLEARED FOR CONSUMPTION, IN THE UNITED KINGDOM, IN THE YEARS 1831, 1832, AND 1833.

	Importations			Exportations			Consumption.	
Years	Cot. Piece Goods of India	Cotton manufactures entered at value	Cotton Yarn.	Cot. Piece Goods of India	Cotton manufactures entered at value.	Cotton Yarn.	Cotton manufactures entered at value (including India Piece Goods.)	Cotton Yarn.
	Pieces	£.	lbs.	Pieces.	£.	lbs.	£	lbs.
1831	1,064,416	31,211	196,796	781,317	15,089	86,613	26,619	91,204
1832	506,184	18,477	181,859	811,716	9,078	116,839	25,399	111,203
1833	300,823	34,537	177,333	583,813	16,386	33,267	28,577	118,707

Tables of Revenue, &c. for 1833, *p.* 160.

It is abundantly clear from the above facts, and from the preference given to British cottons in all foreign markets, that no protection whatever is needed by the manufacturer in the home market. The entire repeal of the protecting duty, therefore, would produce no injurious effect upon the manufacturer, whilst, as an example to foreign nations, it might be beneficial. There would be no merit in the act, but it would in part take from other governments the *argumentum ad hominem* which they now address to our own, when urged to admit our goods on favourable terms into their markets.

The descriptions of cotton goods now manufactured in England and Scotland are exceedingly numerous and diversified. Before the invention of the spinning machinery, only the stronger and coarser fabrics were made, such as the several varieties of fustian, cotton velvets, velveteens, and strong and fancy cords. "For the introduction and improvement of many of these articles, the country is indebted to the late Mr. John Wilson, of Ainsworth. This gentleman was originally a manufacturer of fustians at Manchester, but had early engaged in the manufacture of cotton velvets; and by persevering efforts he succeeded in bringing it to the utmost degree of perfection. His improvement of the mode of dressing, of finishing, and particularly of dyeing these goods, acquired for them so high a character, that, both in the home and foreign market, his articles sold in preference to those of every other manufacturer. His plan for cleaning off the loose and uneven fibres was by the use of razors. He afterwards successively employed, for this end, singeing by spirits of wine, and the application of a hot iron resembling a weaver's drying iron,

which last instrument had been introduced for the same purpose in the manufacture carried on in the Manchester house of correction, by Mr. Whitlow, governor of that institution. At a later period, Mr. Wilson effected his object by drawing the goods rapidly over a cylinder of cast-iron, heated to redness, by which they were in a superior manner cleared of the down or pile which had been raised upon them in the various operations of weaving, washing, bleaching, or dyeing. These successive inventions of Mr. Wilson's, for performing this process, give us some idea of the manner in which improvements are introduced into our manufactures, when, fortunately, the efforts of self-interest are directed by intelligence and talent. The many valuable improvements introduced by Mr. Wilson into the different processes connected with the cotton manufacture, had the effect not only to establish it more firmly, but rapidly to enlarge its extent."* Mr. Wilson's improvements in the art of dyeing have already been mentioned. (p.276.)

After the invention of the spinning machines, the English manufacturers began to imitate the light and elegant fabrics of India; in which they so completely succeeded as soon to banish all fear of the competition of Indian goods. It has already been mentioned, that Arkwright and his partners successfully attempted the manufacture of calicoes about the year 1772 or 1773; and soon afterwards calicoes were made at Blackburn,† which became the principal mart for that description of

* Aikin's Manchester; abridged in the Encyclopædia Britannica.

† The subjoined paragraph is extracted from an old newspaper:—"The following memorandum was wrote in a bible now in the possession of a family at Rishton, near Blackburn,' for the purpose, no doubt, of recording the period when the manufacture of calico was first introduced into this country:—'15th September, 1776. Thomas Duxbury, of Rishton, near Blackburn, sold to Messrs. Peels,

goods. This branch extended with great rapidity, and spread through a large extent of country round Blackburn, and into that part of Yorkshire near Burnley and Colne. It now constitutes by far the largest branch of the manufacture.

The manufacture of the still more delicate and beautiful article, muslin, was attempted both in Lancashire and at Glasgow, about the year 1780, with weft spun by the jenny. The attempt failed, owing to the coarseness of the yarn. Even with Indian weft, muslins could not be made to compete with those of the East. But when the mule was brought into general use, in 1785, both weft and warp were produced in this country sufficiently fine for muslins; and so quickly did the weaver avail himself of the improvement in the yarn, that no less than 500,000 pieces of muslin were manufactured in Great Britain in the year 1787. In a "Report of the Select Committee of the Court of Directors of the East India Company upon the subject of the Cotton Manufacture of this Country," made in the year 1793, it is said, that "every shop offers British muslins for sale equal in appearance, and of more elegant patterns than those of India, for one-fourth, or perhaps more than one-third, less in price." "Muslin began to be made nearly at the same time at Bolton, at Glasgow, and at Paisley, each place adopting the peculiar description of fabric which resembled most those goods it had been accustomed to manufacture; and, in consequence of this judicious distribution at first, each place has continued

Yates, & Co., Church Bank, two common-fine calico pieces for £5. 9s. 8d. These were the first calico pieces ever manufactured in this kingdom.'" This is an erroneous statement, as Arkwright and his partners made calicoes in 1772 or 1773; but these may have been the first pieces of calico manufactured in Lancashire and the memorandum shews the extraordinary price which they fetched.

to maintain a superiority in the production of its own article. Jaconets, both coarse and fine, but of a stout fabric, checked and striped muslins, and other articles of the heavier description of this branch, are manufactured in Bolton, and in its neighbourhood. Book, mull, and leno muslins, and jaconets of a lighter fabric than those made in Lancashire, are manufactured in Glasgow. Sewed and tamboured muslins are almost exclusively made there and in Paisley."* Fancy muslins, woven in the loom, were first made at Paisley, of great variety and elegance, but are now chiefly made at Glasgow.

A familiar but lively and striking description of the great change in the dress of the people, consequent on the introduction of English calicoes and muslins, is given in Macpherson's Annals of Commerce, under the year 1785. It is as follows:—"The manufacture of calicoes, which was begun in Lancashire in the year 1772, was now pretty generally established in several parts of England and Scotland. The manufacture of muslins in England was begun in the year 1781, and was rapidly increasing. In the year 1783, there were above a thousand looms set up in Glasgow for that most beneficial article, in which the skill and labour of the mechanic raise the raw material to twenty times the value it was of when imported. Bengal, which for some thousands of years stood unequalled in the fabric of muslins, figured calicoes, and other fine cotton goods, is rivalled in several parts of Great Britain. The rapid increase in the number of spinning engines, which took place in consequence of the expiration of Arkwright's patent, forms a new era, not only in manufactures and commerce, but also in the dress of both sexes. The

* Encyclopædia Britannica.

common use of silk, if it were only to be worn while it retains its lustre, is proper only for ladies of ample fortune, and yet women of almost all ranks affected to wear it: and many in the lower classes of the middle ranks of society distressed their husbands, parents, and brothers, to procure that expensive finery. Neither was a handsome cotton gown attainable by women in humble circumstances; and thence the cottons were mixed with linen yarn, to reduce their price. But now cotton yarn is cheaper than linen yarn; and cotton goods are very much used in place of cambrics, lawns, and other expensive fabrics of flax; and they have almost totally superseded the silks. Women of all ranks, from the highest to the lowest, are clothed in British manufactures of cotton, from the muslin cap on the crown of the head, to the cotton stocking under the sole of the foot. The ingenuity of the calico printers has kept pace with the ingenuity of the weavers and others concerned in the preceding stages of the manufacture, and produced patterns of printed goods, which for elegance of drawing exceed every thing that ever was imported; and, for durability of colour, generally stand the washing so well, as to appear fresh and new every time they are washed; and give an air of neatness and cleanliness to the wearer, beyond the elegance of silk in the first freshness of its transitory lustre. But even the most elegant prints are excelled by the superior beauty and virgin purity of the muslins, the growth and the manufacture of the British dominions. With the gentlemen, cotton stuffs for waistcoats have almost superseded woollen cloths; and silk stuffs, I believe, entirely: and they have the advantage, like the ladies' gowns, of having a new and fresh appearance every time they are

washed. Cotton stockings have also become very general for summer wear, and have gained ground very much upon silk stockings, which are too thin for our climate, and too expensive for common wear for people of middling circumstances."*

A still more lively and interesting description is given of the change produced in the habits and circumstances of the manufacturing population, during the extraordinary increase of the manufacture, by William Radcliffe, the joint author of the dressing machine, in his book already referred to. He describes the change produced in his own parish of Mellor, fourteen miles from Manchester:—

"In the year 1770, the land in our township was occupied by between fifty to sixty farmers; rents, to the best of my recollection, did not exceed 10s. per statute acre; and out of these fifty or sixty farmers, there were only six or seven who raised their rents directly from the produce of their farms; all the rest got their rent partly in some branch of trade, such as spinning and weaving woollen, linen, or cotton. The cottagers were employed entirely in this manner, except for a few weeks in the harvest. Being one of those cottagers, and intimately acquainted with all the rest, as well as every farmer, I am better able to relate particularly how the change from the old system of hand labour to the new one of machinery operated in raising the price of land. Cottage rents at that time, with convenient loom-shop, and a small garden attached, were from one and a half to two guineas per annum. The father of a family would earn from eight shillings to half-a-guinea at his loom; and his sons, if he had one, two, or three alongside of him, six or eight shillings each per week: but the great sheet-anchor of all cottages and small farms, was the labour attached to the hand-wheel; and when it is considered that it required six to eight hands to prepare and spin yarn, of any of the three materials I have mentioned, sufficient for the consumption of one weaver,—this shews clearly the inexhaustible source there was for labour for

* Vol. IV. p 80.

every person from the age of seven to eighty years, (who retained their sight and could move their hands,) to earn their bread, say one to three shillings per week, without going to the parish.

"From the year 1770 to 1788, a complete change had gradually been effected in the spinning of yarns; that of wool had disappeared altogether, and that of linen was also nearly gone; cotton, cotton, cotton, was become the almost universal material for employment; the hand-wheels were all thrown into lumber-rooms; the yarn was all spun on common jennies; the carding for all numbers up to 40 hanks in the pound was done on carding engines; but the finer numbers of 60 to 80 were still carded by hand, it being a general opinion at that time that machine-carding would never answer for fine numbers: In weaving, no great alteration had taken place during these eighteen years, save the introduction of the fly-shuttle, a change in the woollen looms to fustians and calico, and the linen nearly gone, except the few fabrics in which there was a mixture of cotton. To the best of my recollection, there was no increase of looms during this period, but rather a decrease.

"The next fifteen years, viz. from 1788 to 1803, I will call the golden age of this great trade. Water twist and common jenny yarns had been freely used in Bolton, &c., for some years prior to 1788; but it was the introduction of mule yarns about this time, along with the other yarns, all assimilating together and producing every description of clothing, from the finest book muslin, lace, stocking, &c., to the heaviest fustian, that gave such a preponderating wealth through the loom.

"The families I have been speaking of, whether as cottagers or small farmers, had supported themselves by the different occupations I have mentioned in spinning and manufacturing, as their progenitors from the earliest institutions of society had done before them. But the mule twist now coming into vogue, for the warp, as well as weft, added to the water-twist and common jenny yarns, with an increasing demand for every fabric the loom could produce, put all hands in request, of every age and description. The fabrics made from wool and linen vanished, while the old loom-shops being insufficient, every lumber-room, even old barns, cart-houses, and out-buildings of any description, were repaired, windows broke through the old blank walls, and all fitted up for loom-shops.

This source of making room being at length exhausted, new weavers' cottages, with loom-shops, rose up in every direction; all immediately filled, and, when in full work, the weekly circulation of money, as the price of labour only, rose to five times the amount ever before experienced in this district, every family bringing home weekly 40, 60, 80, 100, or even 120 shillings per week! It may be easily conceived, that this sudden increase of the circulating medium would, in a few years, not only show itself in affording all the necessaries and comforts of life these families might require, but also be felt by those who, abstractedly speaking, might be considered disinterested spectators; but in reality they were not so, for all felt it, and that in the most agreeable way, too; for this money in its peregrinations left something in the pockets of every stone-mason, carpenter, slater, plasterer, glazier, joiner, &c.; as well as the corn-dealer, cheese-monger, butcher, and shopkeepers of every description. The farmers participated as much as any class, by the prices they obtained for their corn, butter, eggs, fowls, with every other article the soil or farm-yard could produce, all of which advanced at length to nearly three times the former price. Nor was the portion of this wealth inconsiderable that found its way into the coffers of the Cheshire squires, who had estates in this district, the rents of their farms being doubled, and in many instances trebled."*

Here is a strongly-drawn picture, (which for spirit, boldness, and truth, may vie with an *interior* of Teniers,) of the cottage of the domestic manufacturer before the spinning machinery was invented; and there is also a familiar, striking, and just history, illustrated by a single specimen, of the growth of the great manufacturing villages and towns, which are now thickly spread over the cotton districts of Lancashire and Cheshire.

There are two extensive manufactures, which, though not carried on in Lancashire, yet call for notice in a history of the cotton manufacture, being founded entirely

* Origin of Power-loom Weaving, by William Radcliffe, p. 59—66.

on cotton yarn; namely, the manufactures of lace and of cotton stockings.

The bobbin-net, or Nottingham lace manufacture, like that of muslin, could have had no existence in England, but for Crompton's invention, the mule, which spins yarn suitable for that delicate fabric. For this manufacture the best quality of cotton is used, spun into the finest yarn, and twisted into thread by the doubling frame. The application of the stocking frame to the making of lace, was first thought of and tried by a frame-work knitter of Nottingham, named Hammond, about the year 1768—that era of great inventions. It was not, however, rendered completely successful till Mr. John Heathcoat, M.P. for Tiverton, made an important alteration and improvement in the frame, for which he obtained a patent in 1809. Mr. Heathcoat began life in humble circumstances at Nottingham, and made his fortune by this happy invention; and, being at once a man of talent and of business, he now fills the honourable station of member of parliament for Tiverton. He removed to the latter place soon after he had obtained his patent, owing to the riotous attacks made on his lace-frames at Nottingham; for that town, though it had derived so much benefit from being the cradle of the two greatest inventions in cotton spinning, became afterwards, through the ignorance of the workmen, the head-quarters of an extensive conspiracy against machinery, known by the name of Luddism, in the counties of York, Lancaster, Nottingham, Derby, Chester, &c. and which was only put down after many men had atoned by their lives for their acts of outrage. On the expiration of Mr. Heathcoat's patent, in 1823, other improvements followed in rapid succession; and such was the perfection

attained in the manufacture, and so surprisingly cheap, as well as beautiful, was the net produced, that this manufacture has nearly destroyed the old manufacture of net by hand upon the pillow in England, Belgium, and France.

The growth of the bobbin-net manufacture, after 1823, was as rapid as that of the cotton manufacture after the nullification of Mr. Arkwright's patent; and the wages of the workmen rose to the same extravagant rate. It has now, after a wonderful extension, fallen into a depressed state, from the quantity of capital and labour having exceeded the demand; and both profits and wages have necessarily declined. Great temporary loss has been sustained owing to the recent invention of new machines, which are capable of producing much more lace than the machines of a few years standing, so as to render the latter nearly worthless. Hand machines, which, when first made, cost £1200 each, are now only worth £60. Machines moved by steam or water power have been introduced, with which the owners of the hand machines can only compete by submitting to a great reduction of profits and wages; and, in consequence, many small masters are sinking into the rank of workmen. So cheap has this beautiful fabric become, that in 1831 a durable and elegant article in bobbin-net, proper for certain useful and ornamental purposes, as curtains, &c., could be sold wholesale for fourpence per square yard, and another article, used for many purposes in female dress, at sixpence per square yard: and since that time a further fall in price has taken place, equal to 20 per cent.

Mr. William Felkin, of Nottingham, the agent of Mr. Heathcoat, of Tiverton, has published at several

distinct periods a brief and able tract, entitled, "*Statistics of the Bobbin Net Trade,*" giving a view of the state of this manufacture. From his publication in August, 1833, the following particulars are extracted :—

Capital employed in spinning and doubling the Yarn.

Fixed capital in 35 spinning and 24 doubling factories—724,000 spinning, 296,700 doubling spindles	£715,000	
Floating capital in spinners' and doublers' stock and necessary sundries . . .	200,000	
	915,000	
Deduct 1-6th, employed for foreign bobbin net trade	155,000	
		£760,000

Capital employed in Bobbin Net making.

Fixed capital in 25 factories, principally for power machines		£. 85,000	
... 1,100 power machines, averaging 11 quarters wide . . .		170,000	
... 3,900 hand machines, averaging 9 quarters wide. . .		267,000	
Floating capital in stock on hand, power owners	£150,000		
... ... hand owners .	250,000		
		400,000	
			922,000
Capital in embroidering, preparing, & stock			250,000
Total capital employed in the trade . . .			£1,932,000

Number of Hands employed.

In spinning: adults, 4,800; children, 5,500 . .	10,300	
In doubling: adults, 1,300; children, 2,000 . .	3,300	
	13,600	
Deduct 1-6th employed for foreign demand . .	2,300	
		11,300
In power net making: adults, 1,500; youths, 1,000; children, 500; women and girls in mending, 2,000 . .		5,000
In hand machine working: small machine owners, 1,000; journeymen and apprentices, 4,000; winders, 4,000; menders, 4,000		13,000
Mending, pearling, drawing, finishing, &c. . . .		30,000
In embroidering, at present very uncertain, probably about		100,000
Total of hands employed		159,300

Value of the Raw Material when imported, and of the Goods manufactured therefrom.

Amount of Sea Island cotton annually used, 2,387,000 lbs. value £179,000. This is manufactured into yarn, weighing 1,532,000 lbs. But of this quantity 262,000 lbs. are sent abroad, leaving 1,270,000 lbs., value £635,000. This yarn, (inclusive of about £10,000 worth of thrown silk,) is worked up into

			£.
5,645,000 yrds.	of hand lever quilling net, averaging fine 11-point, at 1s. 3d. . . .	per square yard.	352,815
2,207,000 —	of hand circular quilling net, averaging fine 11-point, at 1s. 3d.	—	137,935
6,622,000 —	of hand circular plain net, averaging fine 12-point, at 1s. 6d.	—	496,650
4,580,000 —	of hand rotary plain net, averaging common 11-point, 1s.	—	229,000
10,905,000 —	of power plain net, averaging common 11-point, 1s.	—	545,250
562,000 —	of fancy net, averaging 2s. 6d. . . .	—	70,250
250,000 —	of silk net, averaging 1s. 6d. . . .	—	18,750
Total square yards. 30,771,000	Annual produce of English bobbin net, of the present value of		£1,850,650

The manufacture of cotton stockings is of great extent, that being one of the common articles of dress among the population of this country. It is chiefly carried on in Nottinghamshire and Derbyshire. The stocking-frame, though a complex and ingenious machine, was invented so far back as 1589, by a Mr. William Lee, of Woodborough, in Nottinghamshire, who, from want of patronage in this country, took his machine to France, and established the stocking manufacture at Rouen, under the patronage of Henry IV. On the death of that monarch, Lee fell into difficulties, and he died in poverty at Paris. The machine was brought back from France to England by some of the workmen who had emigrated with him, and who established themselves in Nottinghamshire. In the course of the last century the stocking-frame was considerably improved, and it was adapted by Mr. Jedediah Strutt to the making of ribbed stockings. The inventions in cotton spinning of course led to a great extension in the manufacture of cotton stockings. Hargreaves first employed his jenny at Nottingham in spinning yarn for the hosiers. This was in 1770. I have no means of knowing what was the consumption of cotton in this manufacture previously. In 1787, it was estimated that 1,500,000 lbs. of cotton wool was consumed in the hosiery branch: at present it is believed that 4,584,000 lbs. is consumed yearly, of the value of £153,000.

An analysis of the hosiery trade was made in 1812, by Blackner, which Mr. Felkin has continued up to the present time, and which yields the following particulars:—

Cotton hosiery is chiefly made throughout the counties of Nottingham and Derby, at Hinckley, and at Tewkes-

bury. The number of frames employed on the different kinds of goods is thus stated—

Plain cotton, 14 to 22-gauge, 1,600; 24 to 28-gauge, 1,600; 30 to 34-gauge, 2,790; 36 to 60-gauge, 1,600 frames	7,590
Gauze, 600; gloves and caps, 1,000; drawers, 500; sundries, 560	2,660
Wide frames, making cut-ups and various other kinds	6,030
	16,280

The following table contains additional particulars:—

Descriptions of Cotton Hosiery.	Frames.	Pairs of Stockings made.	Quantity of Cotton Yarn consumed	Value of the Yarn.	Wages for making Stockings.	Wages for finishing Stockings.	Value of manufactured Cotton Stockings.
		Dozen.	lbs.	£.	£.	£.	£.
Fashioned Cotton Hose	10,300	420,000	880,000	73,000	220,000	32,000	325,000
Cut-up, &c.	6,000	1,960,000	2,940,000	172,000	285,000	98,000	555,000
Total . .	16,300	2,380,000	3,820,000	245,000	505,000	130,000	880,000

The number of persons employed in the cotton branch of the hosiery trade, will probably amount to nearly 40,000. The fixed capital in mills, machinery, and frames, is estimated by Mr. Felkin at £385,000. The same gentleman estimates the whole of the floating capital in the hosiery business (including the worsted and silk branches) at £1,050,000; of which that belonging to the cotton branch would be about one-half, or £500,000. In 1833, there were exported 468,602 dozen pairs of cotton stockings, which Mr. Burn (*Commercial Glance*) estimates as worth £257,931.

The yarn for the stocking-frame is required to be particularly smooth and equal, and it is therefore spun in a manner different from other yarn, two roves being united to form the thread: on this account it is called double-spun twist.

The making of sewing-thread, by firmly twisting together two, three, or more threads of cotton yarn by machinery, is a considerable branch of business, carried on both at Manchester and in Scotland, and in which Mr. David Holt, of the former place, has made great improvements. The beauty of this article, and its remarkable utility and cheapness, are universally known, as it is used in every house, and in the making of almost every kind of clothing. Several shops in the principal streets of London sell this article only. It is also extensively exported; the quantity sent abroad in 1833 was 1,187,601 lbs.

The following tables will shew at a glance the extent of the British Cotton Manufacture for the last one hundred and thirty-seven years; and the reader will not fail to notice the different rate of increase before and since the great inventions in cotton spinning. All these tables rest on official authority:—

Cotton Wool Imported from 1697 to 1780.

Years.	lbs.	Years.	lbs.
1697	1,976,359	1741	1,645,031
1701	1,985,868	1751	2,976,610
1700 to 1705 (average)	1,170,881	1764	3,870,392
1710	715,008	Average 1771 to 1775	4,764,589
1720	1,972,805	Average 1776 to 1780	6,766.613
1730	1,545,472		

Cotton-Wool Imported and Exported from 1781 to 1819.

Years	Imported.	Exported.	Years.	Imported.	Exported.
	lbs.	*lbs.*		*lbs.*	*lbs.*
1781	5,198,778	96,788	1801	56,004,305	1,860,872
2	11,828,039	421,229	2	60,345,600	3,730,180
3	9,735,663	177,626	3	53,812,284	1,561,053
4	11,482,083	201,845	4	61,867,329	503,171
5	18,400,384	407,496	5	59,682,406	804,243
6	19,475,020	323,153	6	58,176,283	651,867
7	23,250,268	1,073,381	7	74,925,306	2,176,943
8	20,467,436	853,146	8	43,605,982	1,644,867
9	32,576,023	297,837	9	92,812,282	1,354,105
1790	31,447,605	844,154	1810	132,488,935	8,787,109
1	28,706,675	363,442	11	91,576,535	1,266,867
2	34,907,497	1,485,465	12	63,025,936	1,740,912
3	19,040,929	1,171,566	13	50,966,000	
4	24,358,567	1,349,950	14	60,060,239	6,282,437
5	26,401,340	1,193,737	15	99,306,343	6,780,392
6	32,126,357	694,962	16	93,920,055	7,105,034
7	23,354,371	609,058	17	124,912,968	8,155,442
8	31,880,641	601,139	18	177,282,158	15,159,153
9	13,379,278	844,671	19	149,739,820	16,622,969
1800	56,010,732	4,416,610			

Cotton-Wool Imported, Exported, and Entered for Consumption, from 1820 to 1833.

Years.	Quantity Imported	Quantity Exported.	Quantity entered for Consumption.
	lbs.	*lbs.*	*lbs.*
1820	151,672,655	6,024,038	152,829,633
1821	132,536,620	14,589,497	137,401,549
1822	142,837,628	18,269,776	143,428,127
1823	191,402,503	8,318,402	186,311,070
1824	149,380,122	13,299,505	141,038,743
1825	228,005,291	18,004,953	202,546,869
1826	177,607,401	24,474,920	162,889,012
1827	272,448,909	18,134,170	249,804,396
1828	227,760,642	17,396,776	208,987,744
1829	222,767,411	30,289,115	204,097,037
1830	263,961,452	8,534,976	269,616,640
1831	288,674,853	22,308,555	273,249,653
1832	286,832,525	18,027,940	259,412,463
1833	303,656,837	17,363,882	293,682,976

The following table shews the rates of increase in the import of the raw material, and therefore in the manufacture, for the last ninety years:—

RATE OF INCREASE IN THE IMPORT OF COTTON-WOOL, IN PERIODS OF TEN YEARS, FROM 1741 TO 1831.

From 1741 to 1751	81 per cent.
... 1751 to 1761	21½ per cent.
... 1761 to 1771	25½ per cent.
... 1771 to 1781	75¾ per cent.
... 1781 to 1791	319½ per cent.
... 1791 to 1801	67½ per cent.
... 1801 to 1811	39½ per cent.
... 1811 to 1821	93 per cent.
... 1821 to 1831	85 per cent.

From 1697 to 1741, the increase was trifling: between 1741 and 1751, the manufacture, though still insignificant in extent, made a considerable spring: during the next twenty years, the increase was moderate: from 1771 to 1781, owing to the invention of the jenny and the water-frame, a rapid increase took place: in the ten years from 1781 to 1791, being those which immediately followed the invention of the mule and the expiration of Arkwright's patent, the rate of advancement was prodigiously accelerated, being nearly 320 per cent.: and from that time to the present, and especially since the close of the war, the increase, though considerably moderated, has been rapid and steady far beyond all precedent in any other manufacture.

Let us now see how the cotton manufacture has extended the foreign commerce of England. Less than a century ago, the cotton exports of the country were so

insignificant that they are not mentioned by any writer of that period in treating of the commerce between England and foreign countries. Even half a century since, they were as yet a small branch of trade compared with the woollen: but about that period they increased with unparalleled rapidity, and at the beginning of the present century they nearly overtook the woollen exports in amount. At the present day they are three times as large as the woollen exports,—having in so short a period outstripped and distanced a manufacture which has flourished for centuries in England, and which for that length of time all writers on trade had justly considered as the grand source of commercial wealth to the country. The following tables rest on official authority:

COTTON MANUFACTURES EXPORTED FROM GREAT BRITAIN, FROM 1697 TO 1797.

Years.	Official Value of British Cotton Goods of all sorts Exported.	Years	Official Value of British Cotton Goods of all sorts Exported.
	£.		£.
1697	 5,915	178	 915,046
1701	 23,253	1787	 1,101,457
1710	 5,698	1788	 1,252,240
1720	 16,200	1789	 1,231,537
1730	 13,524	1790	 1,662,369
1741	 20,709	1791	 1,875,046
1751	 45,986	1792	 2,024,368
1764	 200,354	1793	 1,733,807
1765	 218,318	1794	 2,376,077
1766	 220,759	1795	 2,433,331
1780	 355,060	1796	 3,214,020
1785	 864,710	1797	 2,580,568

COTTON MANUFACTURES AND YARN EXPORTED FROM GREAT BRITAIN.*

From 1798 to 1833.

Years.	British Cotton Manufactured Goods. Official Value.	British Cotton Manufactured Goods. Declared Value.	Twist and Yarn. Official Value.	Twist and Yarn. Declared Value.	Total Cotton Exports. Official Value.	Total Cotton Exports. Declared Value.
	£.	£.	£.	£.	£.	£.
1798	3,572,217	Records destroyed by fire.	30,271	Records destroyed.	3,602,488	Records destroyed.
9	5,593,407		204,602		5,808,009	
1800	5,406,501		447,556		5,854,057	
1	6,606,368		444,441		7,050,809	
2	7,195,900		428,605		7,624,505	
3	6,412,037		639,404		7,081,411	
4	7,831,564		902,208		8,746,772	
5	8,619,990		911,475		9,531,465	
6	9,753,821		736,225		10,189,010	
7	9,708,046		601,719		10,309,765	
8	12,503,918		472,078		12,986,096	
9	18,425,614		1,020,352		19,415,966	
1810	17,898,519		1,053,475		18,951,994	
1	11,529,551		483,598		12,013,149	
2	15,723,225		794,465		16,517,690	
3	Records de	stroyed.				
4	16,535,528	17,241,884	1,119,850	2,791,248	17,655,378	20,033,132
5	21,480,792	18,946,835	808,853	1,674,021	22,289,645	20,620,956
6	16,183,975	12,948,944	1,380,486	2,628,448	17,564,461	15,577,392
7	20,133,966	13,997,820	1,125,258	2,014,181	21,259,224	16,012,001
8	21,292,354	16,372,212	1,296,776	2,395,305	22,589,130	18,767,517
9	16,696,539	12,180,129	1,585,753	2,519,783	18,282,292	14,699,912
1820	20,509,926	13,690,115	2,022,153	2,826,643	22,531,079	16,516,758
1	21,642,936	13,788,977	1,898,679	2,305,830	23,541,615	16,094,807
2	24,559,272	14,521,211	2,351,771	2,697,590	26,911,043	17,218,801
3	24,119,359	13,650,896	2,425,411	2,625,947	26,544,770	16,276,843
4	27,171,556	15,211,119	2,984,345	3,135,396	30,155,901	18,376,515
5	26,597,575	15,046,902	2,897,706	3,206,729	29,495,281	18,253,631
6	21,445,743	10,522,407	3,748,527	3,491,268	25,194,270	14,013,675
7	29,203,138	13,956,826	3,979,760	3,545,568	33,182,898	17,502,394
8	28,981,675	13,545,188	4,185,842	3,594,926	33,467,417	17,140,111
9	31,810,474	13,420,536	5,458,958	3,974,039	37,269,432	17,394,575
1830	35,395,400	15,203,713	5,655,569	4,132,258	41,050,969	19,335,971
1	33,682,475	13,207,917	5,674,600	3,974,989	39,357,075	17,182,936
2	37,060,750	12,622,880	6,725,505	4,721,796	43,786,255	17,344,676
3	40,058,153	13,754,992	6,279,057	4,704,008	46,337,210	18,459,000

* Parl. Paper, No. 145, sess 1831; and Finance Accounts for 1834. The cotton exports from Ireland to foreign parts are not included in this table, but they are of very small amount: in 1831 their real or declared value was £76,118; in 1832 it was £53,705; and in 1833 it was £27,399.

It is desirable, before proceeding further, to give an explanation necessary to the clear understanding of the above table, and for want of which several members of parliament, who ought to have known better, have drawn from such tables the most erroneous and absurd conclusions. It will be seen, that whilst the *official value* of the cotton exports increased from £17,655,378, in 1814, to £46,337,210, in 1833, the *real* or *declared value* declined from £20,033,132, in 1814, to £18,459,000, in 1833. The *official value*, as is known to all who are conversant with commercial statistics, indicates merely the *quantity* of goods exported, but is no criterion of their actual worth; the quantities being reduced to a money amount, according to a scale fixed many years ago by the custom-house, and never altered. The *real* or *declared value* is the money price, according to the declaration of the exporters, and approaches to the actual worth of the exports, though it is not always accurate. The following are the rates of valuation at the custom-house for cotton goods: (*Parl. Paper*, No. 183, Sess. 1830.)—

RATES OF VALUATION FOR COTTON GOODS AT THE CUSTOM-HOUSE IN 1829.

COTTON MANUFACTURES, viz.		Official Value. £.	s.	d.	Average Rates of Real Value £.	s.	d.
Calicoes, white or plain	*per yard*	0	1	3	0	0	6
—— printed, checked, &c.	*per yard*	0	1	6	0	0	8¾
Muslins, white or plain	*per yard*	0	1	8	0	0	7¾
—— printed, checked, &c.	*per yard*	0	1	10	0	0	9¾
Fustians, velvets, &c.	*per yard*	0	2	6	0	0	10½
Counterpanes	*each*	0	10	0	0	3	2½
Lace and patent net	*per yard*	0	0	8	0	0	3
Hosiery; viz. stockings,	*per doz. pair*	1	10	0	0	11	5
Cotton for sewing	*per lb.*	0	4	0	0	3	3¼
Cotton and linen mixed	*per yard*	0	1	3	0	0	8¼
COTTON TWIST and YARN	*per cwt.*	10	0	0	7	5	0

From this table it will be seen, that the official value differed greatly from the real or declared value in 1829, and that the latter was in every case less than the former. This indicates that a great fall has taken place in the value of the manufactures; and the late Mr. Alderman Waithman often endeavoured to prove, that the country was now giving a much larger amount of its labour for the same price, than it gave in 1814. This conclusion, however, shews that he overlooked several most important circumstances, especially the fall in the price of the raw material, which of course reduces the cost of the manufactured goods; and also the improvements in machinery, which enable the manufacturer to produce a much greater quantity of goods with the same quantity of capital and labour. Since the year 1798, the price of the raw material has fallen to less than *one-fourth* of what it was in that year. The following comparison is drawn from the prices given by Mr. Tooke, in his work on "High and Low Prices," and the Liverpool Price Current of April, 1833:—

COMPARATIVE PRICES OF COTTON WOOL IN 1798 AND 1833.

		Prices of 1798						Prices of 1833				
Descriptions of Cotton.		s.	d.		s.	d.		s.	d.		s.	d.
West India, including Surinam and Berbice	per lb.	2	1	to	3	4	..	0	7	to	0	10
Bowed Georgia	do.	1	10	to	3	9	..	0	6½	to	0	8
Pernambuco	do.	3	1	to	3	5	..	0	8⅞	to	0	10¼
Bengal and Surat	do.	1	8	to	2	2	..	0	4¼	to	0	5½

The following table, furnished by Mr. Kennedy, of Manchester, to a parliamentary committee on East India affairs, shews both the reduction in the cost of the

raw material between 1812 and 1830, and the saving of labour in the same period, from the improvements in the spinning machinery. It serves also to shew the comparative cost of the raw material, labour, and yarn, in England and in India:—

COMPARATIVE STATEMENT OF THE COST OF ENGLISH AND INDIAN YARN IN 1812 AND 1830.

Description of Yarn	English Cotton Yarn: Hanks per day per spindle. 1812	Hanks per day per spindle. 1830	Price of cotton and waste per lb 1812	Price of cotton and waste per lb 1830.	Labour per lb * 1812.	Labour per lb * 1830.	Cost per lb 1812.	Cost per lb 1830.	Indian Cotton Yarn: Cost per lb. 1812 & 1830.	Labour per lb. 1812 & 1830.	Price of cotton & waste per lb 1812 & 1830.
No.			s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
40	2.	2.75	1 6	0 7	1 0	0 7½	2 6	1 2½	3 7	3 4	0 3
60	1.75	2.5	2 0	0 10	1 6	1 0½	3 6	1 10½	6 0	5 8½	0 3½
80	1.5	2.	2 2	0 11¼	2 2	1 7½	4 4	2 6¾	9 3	8 10½	0 4½
100	1.4	1.8	2 4	1 1¼	2 10	2 2½	5 2	3 4¼	12 4	11 11	0 5
120	1.25	1.65	2 6	1 4	3 6	2 8	6 0	4 0	16 5	16 0	0 5
150	1.	1.33	2 10	1 8	6 6	4 11	9 4	6 7	25 6	25 0	0 6
200	.75	.90	3 4	3 0	16 8	11 6	20 0	14 6	45 1	44 7	0 6
250	.05	.06	4 0	3 8	31 0	24 6	35 0	28 2	84 0	83 4	0 8

* Wages are estimated at the same rate, or at 20d. a day, for every person employed, men, women, and children, in 1812 and 1830, the saving being entirely in the better application of the labour.

This table has reference only to the cost of spinning and the price of yarn. But still greater improvements have been made in weaving, by which more goods are produced with the same expenditure of labour. As the spinner and manufacturer, therefore, for the same outlay

of capital, get so much more of the raw material, and so many more goods spun and woven, they can afford to sell a greatly increased quantity of those goods for the same price. In the year 1814, moreover, the prices of cotton goods were immoderately high, owing to the American war, which raised the cost of the raw material, and still more owing to the peace in Europe, which caused an immense exportation of British manufactures. Add to these considerations, that the value of money has risen very considerably since 1814, in which year the currency was depreciated at least *thirty per cent.*; and the great variation between the official and the real or declared value, which has been gradually taking place, is nearly accounted for. It must be admitted, however, that in one very important department of the manufacture, the weaving, a great decline has taken place in the remuneration of the workmen: this is to be lamented, but it has arisen, as will afterwards be shewn, from causes over which the legislature had no control; and in no other branch of the manufacture is the condition of the workmen less advantageous than it was in 1814.

It is beyond all question that the wages of the spinners, and of all the work-people employed in the mills, are high, and that they will command more of the necessaries and comforts of life now than they would during the war. Yet such have been the improvements in the machinery, even since the close of the war (in 1815), that yarn is now sold at one-third of the price which it commanded in that year; as is shewn by the following statement, the particulars of which were laid before the Commons' Committee on Manufactures, &c.

by Mr. George Smith, of the firm of Jas. Massey & Son, spinners, manufacturers, and commission-agents, of Manchester*:—

PRICES OF WARP, WEFT, & COTTON-WOOL FROM 1815 TO 1833.

Years	Average selling Price of 30 hanks Water-Twist, of common quality, *per lb*		Average selling Price of 40 hanks Cop Weft, *per lb*		Price of 18 oz of Cotton Wool, required to make 1 lb of the Twist or Weft		Average selling Price of a Four-cut Warp	
	s.	d.	s.	d.	s.	d.	s.	d.
1815	—	—	3	0½	1	10	28	11¼
1816	—	—	2	7½	1	8¾	26	1½
1817	—	—	2	6	1	10½	25	0¾
1818	2	9	2	6	1	10½	25	9¾
1819	2	1	1	10½	1	3¼	20	9
1820	1	10½	1	7¼	1	1¼	18	0½
1821	1	6½	1	5¼	0	10¾	15	10½
1822	1	5½	1	4¾	0	9	15	2
1823	1	6¾	1	4¼	0	9¼	15	2½
1824	1	7¼	1	3½	0	9½	14	10¼
1825	1	7¼	1	5½	1	1¼	16	3
1826	1	1	1	1	0	7½	11	2½
1827	1	0½	1	0½	0	7	10	3¼
1828	1	0⅛	0	11¾	0	7¼	10	0½
1829	1	0½	0	11¾	0	6½	9	9¼
1830	1	0¼	1	0¼	0	7½	10	1½
1831	0	10½	0	11¼	0	6½	9	1½
1832	0	11¾	0	11¼	0	7¼	9	8¼
To May 1833	0	11½	1	0	0	8	10	2¼

Another table, presented to the Committee by Mr. James Grimshaw, spinner and manufacturer, of Barrowford, near Colne, shows the comparative prices of yarn and of piece goods, from 1814 to 1833†:—

* Report, p 569, 570. † Report, p. 607

COST AND SELLING PRICE OF ONE PIECE OF CALICO, FROM 1814 TO 1833.

Years	Price of one Piece in Warp	Price of one Piece in Weft.	Expense of Sizing, &c.	Cost Price of one Piece, first seven Years being 2d quality 74's, rest 3d, 74's.	Average Prices sold for in Manchester through the Year.
	s. d.	s. d.	d.	£. s. d.	£. s. d.
1814	9 5	7 5½	6	1 3 10½	1 4 7
1815	7 10¼	6 3	—	0 18 10½	0 19 8¾
1816	7 0½	5 5¼	—	0 16 4¼	0 [illegible] 8½
1817	6 6¾	5 2	—	0 15 3	0 16 1
1818	6 9	5 4½	—	0 16 2½	0 16 8½
1819	5 3¼	4 2	—	0 13 0¼	0 13 9
1820	4 2½	3 6	—	0 11 1½	0 12 1½
1821	3 9¼	2 6	5	0 9 10½	0 9 8¼
1822	3 8¼	2 3	—	0 8 11	0 9 3½
1823	3 8¾	2 2½	—	0 8 8¼	0 8 11¼
1824	3 8¼	2 2½	—	0 8 5¼	0 8 5¼
1825	3 1	2 2	—	0 8 0½	0 8 5¼
1826	2 8	1 10	—	0 6 2¾	0 6 3¼
1827	2 6½	1 9½	—	0 6 3½	0 6 6
1828	2 8	1 9	—	0 6 4½	0 6 5¼
1829	2 8	1 9	—	0 5 11	0 5 8
1830	2 9	1 10½	—	0 6 5½	0 6 3¼
1831	2 3½	1 9½	—	0 6 0¼	0 6 2¼
1832	2 1	1 9	—	0 5 8¾	0 5 8
1833	2 5	1 9¼	—	0 5 10¾	0 6 2

A comparison of the fifth and sixth columns in the above table will shew that the profits of the manufacturer have been small; and it is certain that in every branch of the trade the profits of the capitalist have been greatly reduced within the last twenty years. In this respect, however, the cotton trade only resembles almost every other branch of industry in the country: the interest of money and the profits of capital have fallen universally: but profits are still sufficient to allow of a great accumulation of capital in the manufacture, as is evident from the continual erection of new mills,

and the remarkable extension and improvement of the towns where the business is carried on.

The gain to the nation, from the production of clothing at so much less cost, and of so much better quality, must never be overlooked. Another table may be added to the above, which will yet more strikingly exhibit the reduction made in the price of cotton clothing by the effect of machinery :—

PRICE OF COTTON YARN, No. 100, FROM 1786 TO 1832.

In the year	1786,	yarn No. 100, sold for	38s.
. . .	1787	. . . . .	38s
. . .	1788	. . . . . .	35s.
. . .	1789	. . . . .	34s.
. . .	1790	. . . . . .	30s.
. . .	1791	. . . . .	29s. 9d.
. . .	1792	. . . . . .	16s. 1d.
. .	1793	. . . . .	15s. 1d.
.	1794	. . . . . .	15s. 1d.
.	1795	spun from Bourbon cotton	19s.
. . .	1796	Ditto .	19s.
. . .	1797	. . . . .	19s.
. . .	1798	from Sea Island cotton	9s. 10d.
. . .	1799	. . . . . .	10s. 11d.
. . .	1800	. . . . .	9s. 5d.
. . .	1801	. . . . . .	8s. 9d.
. . .	1802	. . . . .	8s. 4d.
. .	1803	. . . . . .	8s. 4d.
. . .	1804	. . . . .	7s. 10d.
. . .	1805	. . . . . .	7s. 10d.
. . .	1806	. . . . .	7s. 2d.
. . .	1807	. . . . . .	6s. 9d.
		After many fluctuations, in	
. .	1829	it sold for . .	3s. 2d.
. . .	1832	. . . .	2s. 11d.

Thus the price of this kind of yarn has fallen to *one-thirteenth* of its price forty-six years since, whilst its quality is greatly improved, inasmuch as it is better spun. Manufactured goods have undergone a similar reduction.

It is impossible to estimate the advantage to the bulk of the people, from the wonderful cheapness of cotton goods. The wife of a labouring man may buy at a retail shop a neat and good print as low as fourpence per yard, so that, allowing seven yards for the dress, the whole material shall only cost *two shillings and four pence*. Common plain calico may be bought for 2½d. per yard. Elegant cotton prints, for ladies' dresses, sell at from 10d. to 1s. 4d. per yard, and printed muslins at from 1s. to 4s., the higher priced having beautiful patterns, in brilliant and permanent colours. Thus the humblest classes have now the means of as great neatness, and even gaiety of dress, as the middle and upper classes of the last age. A country-wake in the nineteenth century may display as much finery as a drawing-room of the eighteenth; and the peasant's cottage may, at this day, with good management, have as handsome furniture for beds, windows, and tables, as the house of a substantial tradesman sixty years since.

The cotton manufacture, like every other extensive branch of trade, has had its seasons of depression; some of them produced by periods of national distress and exigency, and some by causes peculiar to itself; but from each of these it has recovered with surprising elasticity, and has afterwards sprung forward with an unabated rapidity of increase. An enlightened merchant and cotton spinner, Mr. Kirkman Finlay, of Glasgow and London, spoke the language of experience before a

parliamentary committee, when he said—"I have seen a great many overthrows in the cotton manufacture: in 1788 I thought it was never to recover; in 1793 it got another blow; in 1799 it got a severe blow, and in 1803 again, and in 1810; and at particular periods one would have thought that it was never to extend again; but at every time that it received a blow, the rebound was quite wonderful."* The same well-informed witness pronounced the following opinion on the present state of the trade:—"With respect to the cotton manufacture, with which I am connected, I think its character is one of great extension, of a rapid sale and activity, but making very moderate returns of profit." "I attribute the low state of profit not to any want of demand, if we compare the demand now with the demand at any former period; but to an extremely extensive production with reference to the demand, arising out of a great competition, doubtless caused by the high rate of profit in former times, which, by attracting a large amount of capital to the business, has necessarily led to the low rate of profit we now see." "I think that the stocks on hand are inconsiderable; that the payments are good; that if there is any thing unhealthy, it arises from a practice which has greatly prevailed of late years, of the manufacturer making large consignments of his productions to foreign countries, and receiving bills in advance, and discounting those bills with monied persons in London and other parts of the country, which has led to a greater extension of the trade than otherwise would have taken place." "I think the other branches of

* Report of the Select Committee of the Commons on Manufactures, Commerce, and Shipping; (16th May, 1833) p. 45.

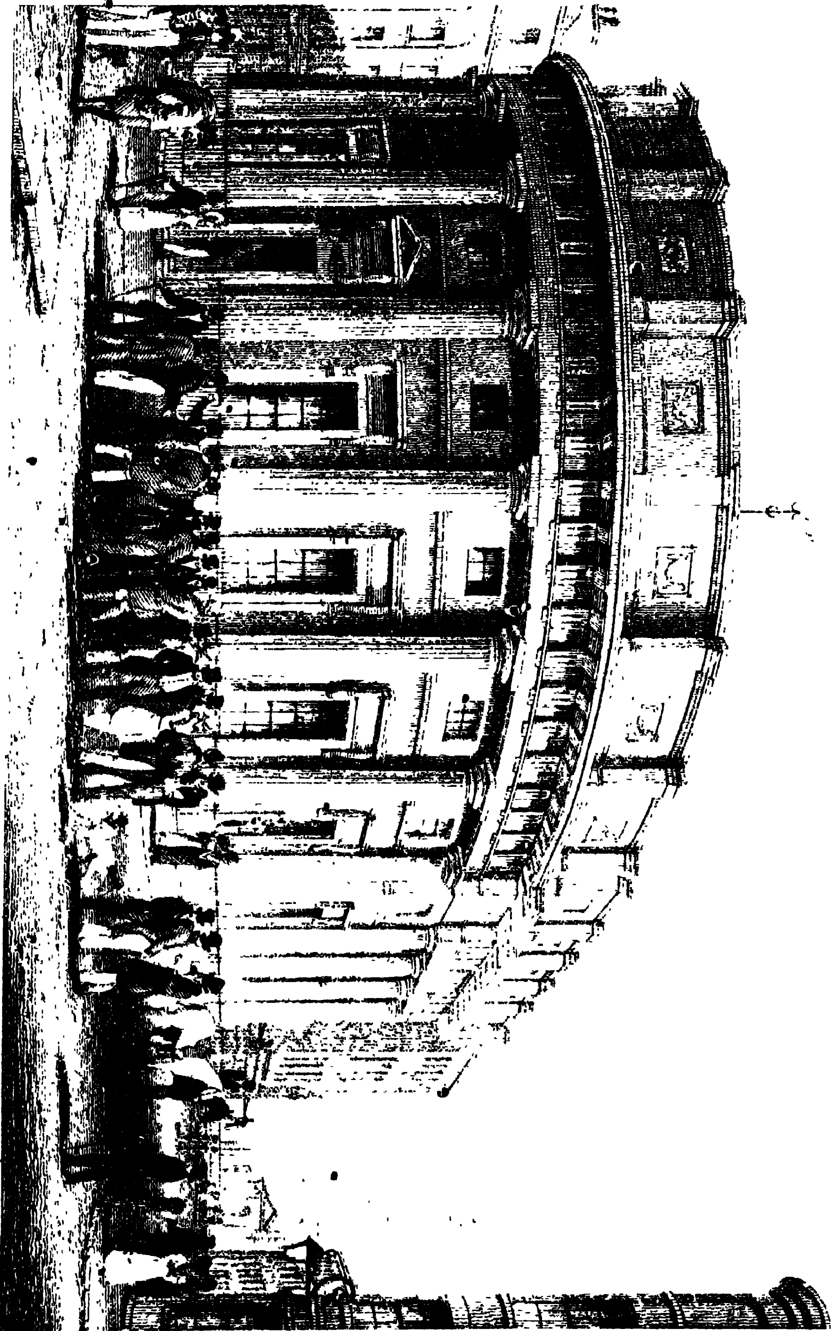
the trade are perfectly healthy, whenever it has reference to the home trade, or to the nearer markets."*

Of the fifteen hundred thousand individuals whom the cotton manufacture now supports, the greater number are in the county of Lancaster. In the year 1700, Lancashire numbered only 166,200 inhabitants, (about the present population of one of its seaports, and less than that of its manufacturing metropolis;) in 1750, the population was 297,400; in 1801, it had grown to 672,565, and in 1831, to 1,336,854; being an increase of more than *eight fold* in 130 years, of *four and a half fold* in the last 80 years, and of *two fold* within the last 30 years! The population of Lanarkshire and Renfrewshire, the principal seats of the manufacture in Scotland, has increased in an almost equal proportion. The parish of Manchester has increased from 41,032 inhabitants in 1774, to 270,961 in 1831, (the date of the last census;) Liverpool, from 34,050, in 1770, to 165,175; Glasgow, from 28,300, in 1763, to 202,426; Paisley, from 17,700, in 1782, to 57,466; Preston, from 6,000, in 1780, to 33,112; Blackburn, from 5,000, in 1770, to 27,091; Bolton, from 5,339, in 1773, to 43,396; Wigan, from 10,989, in 1801, to 20,774; Ashton, from 5,097, in 1775, to 33,597; the parish of Oldham, from 13,916, in 1789, to 50,513.

Such are the amazing creations of the cotton machinery. At the beginning of the reign of George III. (in 1760,) probably not more than *forty thousand* persons† were supported by the whole cotton manu-

* Ibid. p. 35.

† My reasons for thinking that little more than 40,000 persons were supported by the cotton manufacture in 1760 are as follows. The entire value of the cotton goods produced at that time has been shewn (p. 217) to be £600,000 a year. The



facture: machines have been invented, which enable one man to produce as much yarn as two hundred and fifty or three hundred men could have produced then, —which enable one man and one boy to print as many goods as a hundred men and a hundred boys could have printed formerly: and the effect has been, that now the manufacture supports *fifteen hundred thousand* persons, or upwards of *thirty-seven times* as many as at the former period! Yet so profoundly ignorant, or so blindly prejudiced, are some men, even authors and members of parliament, that they still publish solemn lamentations over the growth of ma-

quantity of cotton-wool imported was between 3 and 4,000,000 lbs. a year. It may be supposed, that 3,000,000 lbs. would be consumed in the manufacture, which, at 1s per lb. (about the price of cotton at that time,) would amount to £150,000. The Hamburg, Scotch, and Irish linen yarn, used as warps for the cotton goods, would cost about the same sum—£150,000. On a return of £600,000, the profits of capital would not then be less than £80,000. After deducting the cost of the raw material and the profits of capital, the remainder, £220,000, would be the wages of labour. It may be presented thus—

Value of British cottons manufactured in 1760		£600,000
3,000,000 lbs. of cotton-wool, at 1s. per lb. . .	£150,000	
Linen warp for the goods	150,000	
Profits of capital	80,000	
Wages of spinners, weavers, &c.	220,000	£600,000

The wages of the spinners were then very low, not exceeding from 2s. to 3s. per week, those of the weavers, dyers, fustian-cutters, &c. would be much higher; and it would probably be a fair average to suppose that each person employed earned 5s. per week. But £220,000 a year would only pay 16,924 work-people 5s. per week each. As weavers and spinners were very generally of one family, it will be sufficient if we allow 2½ individuals to be supported by the wages of each labourer: 16,924 multiplied by 2½, gives 42,310 persons supported by the cotton manufacture in 1760. When it is remembered that the cotton manufacture was at this time confined to the county of Lancaster, and that the whole population of that county in 1750 was only 297,400, the conclusion we have arrived at, viz. that 42,310 persons were dependent on the cotton manufacture, will be thought rather too large than too small a number.

chinery! It might have been supposed, that the history of the cotton manufacture would have for ever put an end to the complaints against machinery, except on the part of the workmen who were immediately suffering, as some generally will for a time, from the changes in manufacturing processes. The 150,000 workmen in the spinning mills produce as much yarn as could have been produced by 40,000,000 with the one-thread wheel; yet there are those who look on it as a calamity that human labour has been rendered so productive! These persons seem to cherish secretly the preposterous notion, that, without machinery, we should have had as many hands employed in the manufacture, as it would require to produce the present quantity of goods by the old processes; not considering that the population of all Europe would have been quite inadequate to such a purpose; and that, in reality, not one-fifth part of those now employed as spinners ever would have been employed under the old system, because there would have been little or no increased demand for the coarse and high-priced goods then made. If a spinner can now produce as much in a day as he could last century have produced in a year, and if goods which formerly required eight months to bleach, are now bleached in two days, surely these are the very causes of the amazing extension of the manufacture, and are therefore subjects of rejoicing, not of lamentation.

CHAPTER XV.

EXTENT AND VALUE OF THE MANUFACTURE.

The Statistics of the Cotton Manufacture very imperfect.—Difficulty of obtaining accurate accounts of its extent and value.—Some valuable information collected by the Factory Commissioners.—Cotton-wool imported and entered for consumption in 1833.—Mr. Burn's statement of cotton yarn spun in England and Scotland.—Number of spindles.—Mr. Kennedy's estimate in 1817 of cotton-spinning.—Mr. S. Stanway's estimate of the number of persons employed in the cotton-mills of England in 1832, their ages, sex, earnings, kinds of occupation, and length of day's work. Tables from the Report of the Factory Commission. —Examination of this estimate.—Number of power-loom weavers and power-looms in Great Britain; of hand-looms.—Valuable statistical information obtained from the Factory Inspectors: Tables of the cotton mills, number of persons employed, and steam and water power, in Lancashire and other counties of England, Scotland, and Ireland.—Number of calico-printers, lace and cotton-stocking makers.—Other employments connected with the cotton manufacture.—Mr. M'Culloch's estimate of the number of hands and capital employed, wages, &c.—Mr. Burn's estimate made on different principles: he neglects the evidence of the "real or declared value" of the exports: statement to show that that value is worthy of reliance.—Mr. Burn's estimate of the yearly value of the cottons exported.—Mr. Kennedy's estimate of the value of the manufacture.—Objections to both, as too low.—Value of the manufacture in Scotland and Ireland.—Table of the estimated yearly value of the British Cotton Manufacture.—Capital employed in the Cotton Manufacture.—Exports of British cottons to foreign countries.—Topography of the manufacture; descriptions of cotton goods made in Lancashire, and at what places.—The great print-works and bleach-works, where situated.—Information extracted from the Population Returns of 1831, relative to the cotton manufacture in Lancashire, Cheshire, Derbyshire, Nottinghamshire, Cumberland, Lanarkshire, and Renfrewshire.—Table of inhabitants, and their occupations. —Observations.—Other parts of England, Scotland, and Ireland where the manufacture exists.—Conclusion from the whole.—Table of the extent and value of the British Cotton Manufacture in 1833.—Illustrations of its vast magnitude.

The statistics of the cotton manufacture, as of all the other great manufactures of the country, are very imperfect. Government has never taken measures for ascertaining the number of persons employed and sup-

ported by the manufacture, the amount of capital engaged in it, the value of goods produced, the proportions of wages, profits, and cost of raw material which go to make up that value, the relative importance of the several branches of the manufacture, or the localities in which they are carried on. The Population Returns, which might be expected to have shewn the numbers of persons engaged in each department of industry, do not even distinguish between those employed in the manufactures of cotton and of silk, in the counties of Lancaster and Chester. The records of the customs only furnish, in such a manner as to give precise information, the quantity of cotton-wool imported and entered for consumption, and the quantity, or rather the measurement, of cotton goods exported; for the valuations must be considered as but an approximation to the truth. Up to 1830, the books of the excise shewed the extent of the calico printing, but, since the repeal of the duty, this means of information has ceased.

Nor has any private survey supplied the information which government has failed to collect. Political economists, and well-informed individuals engaged in the manufacture, have at different times made calculations of the extent and value of the cotton trade: but they have had so few accurate data on which to proceed, and have been obliged to assume and conjecture on so many points, that their calculations differ widely from each other, and none is entitled to claim authority.

It must be acknowledged, that great difficulty will always attend the acquirement of full and exact information concerning the extent and value of the cotton manufacture; for, though the hands *directly* employed in the trade might be ascertained with tolerable accuracy,

there are many *auxiliaries* of whom it would not be easy to say whether they properly belonged to the trade or not—such as the men employed in building the mills, in importing the raw material, in raising iron from the mine for the construction of machines, &c. &c. These depend on the cotton manufacture, but some of them do not wholly depend upon it; and it is impossible to say how many are thus dependent, or to what extent. Even the farmer who raises food for the cotton manufacturer is really dependent upon this branch of industry, because, if it did not exist, there would be a less demand for agricultural produce; but no census or calculation can follow all the chains of connexion which bind the different occupations of society together, or, where the dependence is mutual, can decide precisely which is the main spring of production.

Within the last two years, however, the materials for judging of the extent of this vast and newly-created field of industry have been materially increased. "His Majesty's Commissioners appointed to collect information in the manufacturing districts, as to the employment of children in Factories," justly appreciating the importance of the interests which would be affected by legislation, made their inquiries so comprehensive and minute, that, if there had been time to complete them, we should have been in possession of a most valuable and extensive body of statistical information. That time was not afforded; but yet so many answers were received from the proprietors of factories, to the questions sent to them, as to furnish better grounds for calculating the numbers, wages, and physical condition of the work-people engaged in the cotton mills, than existed previously. Some additional help may be

derived from the evidence given before the Commons' Committee on Manufactures, Commerce, and Shipping, in 1833; and some from the "Tables of Revenue, Population, Commerce," &c. compiled by the Board of Trade. The appointment of Factory Inspectors presents the means of gaining more complete and exact knowledge, concerning all the branches of industry carried on in factories; but as yet these officers have scarcely had time to obtain such particulars, even if their attention had been directed to the object. It is to be hoped, that by this or some other machinery, that full and authentic information may be acquired, which constitutes the only sure guide of legislation, and the want of which is discreditable to the first manufacturing country in the world.

The quantity of cotton-wool imported and entered for home consumption is known with certainty from the books of the custom-house; and in 1833 it was, as follows:—

Quantity of Cotton-Wool imported into the United Kingdom, in the year 1833.	Quantity entered for home consumption, in 1833.
lbs.	*lbs.*
303,656,837	293,682,976

Particulars as to the quantity of cotton consumed in the manufacture, the quantity of yarn produced, the proportions spun in England and Scotland, and the weight of yarn exported from England, in the state of yarn and of manufactured goods, will be found in the subjoined table, extracted from "Burn's Commercial Glance," an annual publication compiled by a Manchester commission merchant, chiefly from custom-house reports, and which is considered by persons in the trade to be as correct as such a document can be rendered—

Statement of Cotton spun in England *and* Scotland *in the Year* 1833, *and the quantity of Yarn produced, separately shewing the quantity spun in* England, *and how disposed of.*

	Number of bags consumed.	Average weight of bags.	Total weight in lbs.	Weekly consumption of bags, describing each sort.
American Cotton	638,310	354	225,961,710	12,275 ÷ 10
Brazil ditto	142,730	183	26,319,590	2,744 ÷ 42
Egyptian ditto	13,228	220	2,920,500	254 ÷ 20
East India ditto	72,569	330	24,277,770	1,305 ÷ 29
West India ditto	10,652	300	3,195,600	204 ÷ 44
Total number of Bags consumed . .	877,489	lbs.	282,675,200	16,875 ÷ 41
Allowed for loss in spinning 1¾ oz. per lb. . .			30,917,600	
Total quantity of yarn spun in England and Scotland			. . .	lbs. 251,757,600
Deduct yarn spun in Scotland in 1833			. . .	24,474,931
Total quantity of yarn spun in England			. . .	lbs. 227,282,669
HOW DISPOSED OF.			lbs.	
Exported in yarn during the year . . .			67,760,822	
—— thread			1,187,601	
—— manufactured goods . . .			76,246,339	
Estimated quantity of yarn sent to Scotland and Ireland			5,500,000	
Exported in mixed manufactures, not stated in the above-named articles, consumed in Cotton Banding, Healds, Candle and Lamp Wick, Waddings, Flocks, and loss in manufacturing Goods			12,000,000	
Balance left for Home Consumption and Stock .			64,587,907	227,282,669

The "Commercial Glance" for 1832 contained the following calculation:—

The quantity of cotton yarn spun in England in 1832 was 222,596,907 lbs., averaging weekly 4,280,709 lbs. at 8½ oz. per

spindle, shews the number of spindles used to be 7,949,208. The capital invested in buildings and machinery, to produce the same, at the present valuation of 17s. 6d. per spindle, shews the amount to be £6,955,557.

The quantity of yarn manufactured in England in the year, and exported in manufactured goods	lbs. 61,251,380
For home consumption	70,941,404
Total	lbs 132,192,784

Divided by 52, shews a weekly consumption of lbs 2,542,169
Each loom averaging 12½ lbs. of yarn weekly, shews the number employed in England 203,373.

Mr. Burn's calculation of the number of spindles used in England approaches to 8,000,000; and if we add those used in the Scotch and Irish manufactures, which will be about one-sixth of those in England, the total number of spindles in the cotton manufacture of the United Kingdom will be about 9,333,000. This agrees very well with Mr. Kennedy's calculation in 1829, when he stated that about 7,000,000 mule-spindles were at work in Great Britain: allowing for the increase since that time, and for the throstle spindles, there will be a near approximation between the two calculations. Mr. Bannatyne's opinion supports the same conclusion.

Some reasons will hereafter be stated for differing from Mr. Burn's estimate of the number of looms.

In 1817 Mr. Kennedy published the following estimate, which has always been considered to be carefully and justly made, in his paper "On the Rise and Progress of the Cotton Trade:"—*

* Memoirs of the Manchester Literary and Philosophical Society, Vol. III. second series, p. 131.

MR. KENNEDY'S ESTIMATE IN 1817.

In the year 1817, from authentic documents and the best estimates I could draw from them, the quantity of raw cotton consumed or converted into yarn, in Great Britain and Ireland,

was	110,000,000 lbs.
Loss in spinning, estimated 1½ oz. per lb.	10,312,500 lbs.
Quantity of yarn produced . . .	99,687,500 lbs.
Number of hanks (supposing the average to be 40 per lb.)	3,987,500,000
Number of spindles employed (each spindle being supposed to produce 2 hanks per day, and 300 working days in the year) . .	6,645,833
Number of persons employed in spinning, (supposing each to produce 120 hanks per day)	110,763
Number of horses' power employed (supposing 4½ oz. of coal to produce 1 hank of No. 40, and 180 lbs. of coal per day equal to one horse's power)	20,768

Another estimate has been formed, so recently as last year, of the number of persons engaged in cotton spinning and power-loom weaving in England, of the productive power of each workman engaged in spinning, and of the numbers and earnings of the different classes of workmen in the mills. This calculation was drawn up by Mr. Samuel Stanway, an eminent accountant in Manchester, from the returns made by the mill-owners in the cotton district of Lancashire, Cheshire, and Derbyshire, to a series of questions prepared by himself, under the direction of Mr. John W. Cowell, the factory commissioner, and which were in substance as follows—"What quality of work were you engaged in spinning during the month ending 4th May, 1833; what was the total number of hours

which your mill worked during that month; and what was the total amount of net earnings paid by you to the total number of each denomination of operatives for that number of hours' work, classing them as adults, adolescents, and children, and according to their sexes." With the questions were sent tabular forms, which, being filled up, were returned, to the number of 300; and out of these Mr. Stanway selected 151 as being both accurate and complete, 70 more as being accurate so far as the replies extended, but not complete in all particulars, and 4 from mills which work by night as well as by day: from these 225 returns, he compiled the subjoined tables. The 1st and 2nd tables were compiled exclusively from the 151 complete returns; the 3d and 4th from the whole 225:—*

* Supplementary Report from Factory Commissioners, part I. pp. 123, 124, 136

TABLE I.*

SUMMARY of the Returns made by the Owners of 151 COTTON MILLS in Lancashire, Cheshire, and Derbyshire, to the Questions of the Factory Commissioners, shewing the number of Persons employed in these mills in the different Places mentioned, their Ages, Sex, &c. the Aggregate Net Earnings of the whole number, and the Average Net Earnings of an individual in each place, for 69 hours' work, in the month ending 4th May, 1833.

Place of Employment.	Adults*		Children under 18 years						Total number employed	Aggregate number of hours worked by the whole, during the month ending 4th May, 1833.	Average number of hours worked by each	Aggregate amount of their net earnings for the month ending 4th May, 1833			Average weekly net earnings of each individual, calculated for 69 hours.
			Males.			Females.									
	Males	Females	In the direct employ of Masters	In the direct employ of Operatives.	Employers uncertain	In the direct employ of Masters	In the direct employ of Operatives	Employers uncertain				£.	s.	d.	Pence.
Manchester and immediate neighbourhood . .	4,421	5,731	1,423	2,349	29	1,957	1,451	29	17,390	4,737,977 . 1	272 . 4	35,089	2	3½	122 . 64
Stockport & Heaton Norris . .	2,314	2,175	609	917	30	883	525	38	7,491	2,057,002 . 0	274 . 5	16,399	7	6¾	132 . 02
Duckenfield and Stayley Bridge.	1,251	1,256	87	458	7	240	192	25	3,516	1,016,789 . 0	269 . 1	7,822	2	6	127 . 39
Hyde, Brinnington, &c. . .	1,936	2,451	698	598	27	1,402	127	10	7,249	2,020,639 . 5	278 . 7	16,629	6	0½	136 . 28
Tintwistle, Glossop, &c. . .	728	675	108	445	19	262	227	18	2,482	678,228 . 7	273 . 2	4,951	4	0	120 . 89
Oldham . . .	1,318	824	198	575	40	506	276	38	3,775	987,294 . 0	261 . 5	7,577	3	3	127 . 09
Bolton	1,443	1,279	356	1,069	—	657	665	—	5,469	1,510,964 . 0	276 . 2	10,174	8	0½	111 . 50
Warrington . .	207	235	38	105	—	63	68	—	716	200,951 . 0	280 . 6	1,320	3	7½	108 . 79
One mill at Bury	122	195	68	41	—	121	10	—	557	152,339 . 5	273 . 5	1,009	1	7½	109 . 69
	13,740	14,821	3,585	6,557	152	6,091	3,541	158	48,645	13,362,204 . 8	274 . 6	100,971	18	11¼	125 . 13

* The word "Adult" is used throughout these tables to signify a person who has completed the 18th year of age

TABLE II.

Distributing the 48,645 Persons (in Table I.) into eight different Branches or Departments of Cotton Working, and shewing the Aggregate Net Earnings of the whole number of the Operatives in each Branch, and the Average Net Earnings of an Operative in each, for 69 hours' work.

Employed in	Adults: Males.	Adults: Females.	Children under eighteen years. Males. In the direct employ of Masters.	Children: Males. In the direct employ of Operatives.	Children: Males. Employers uncertain.	Children: Females. In the direct employ of Masters.	Children: Females. In the direct employ of Operatives.	Children: Females. Employers uncertain.	Total number employed.	Aggregate number of hours worked by the whole, during the month ending 4th May, 1833.	Average number of hours worked by each.	Aggregate amount of their net earnings for the month ending 4th May, 1833. £.	s.	d.	Average weekly net earnings of each individual in each branch, calculated for 69 hours. Pence.
Cleaning & spreading Cotton	272	689	212	1	9	91	2	3	1,282	353,660 . 5	275 . 8	2,111	1	5	98 85
*Carding	2,350	3,501	1,229	81	18	2,061	117	40	9,397	2,591,188 . 7	275 . 7	17,252	16	8½	110 . 26
†Mule Spinning	5,163	1,189	697	5,852	50	346	2,284	21	15,605	4,291,208 . 6	274 . 9	33,057	12	2¾	127 . 57
Throstle Spinning	194	688	373	4	32	500	4	51	1,846	501,621 . 5	271 . 7	2,819	1	6½	93 . 06
Reeling	146	2,552	40	5	—	542	23	8	3,316	906,261 . 8	273 . 2	5,213	14	3¾	95 . 26
‡Weaving	4,627	6,108	986	610	55	2,538	1,104	32	16,040	4,400,274 . 7	274 . 3	36,080	19	11	135 . 78
Roller covering	61	87	5	1	—	9	7	—	170	47,268 . 3	278 . 0	414	15	7	145 . 31
As engineers, firemen, mechanics, &c.	927	7	43	3	8	1	—	—	989	270,720 . 7	273 . 7	4,021	17	2¾	246 . 01
	13,740	14,821	3,585	6,557	152	6,091	3,541	158	48,645	13,362,204 . 8	274 . 6	100,971	18	11¼	125 . 13

* *Carding* includes the operations of carding, drawing, and roving, in which the operatives are called carders, jack-frame tenters, bobbin-frame tenters, and drawing tenters.

† *Mule-spinning* includes the spinners, piecers, and scavengers: the piecers are employed in piecing the broken threads, and the scavengers in sweeping up the waste cotton.

‡ *Weaving* includes the warpers, weavers, and dressers.

TABLE III.

SUMMARY of the Returns made by the Owners of 225 COTTON MILLS in Lancashire, Cheshire, and Derbyshire, to the Questions of the Factory Commissioners, shewing the number of Persons employed in those Mills in the different places mentioned, their Ages, Sex &c. and the Aggregate Net Earnings of the whole numbers at each place, realized by them during the Month ending 4th May, 1833; and other Particulars.

Place where employed.	Adults.		Children under 18 years.						Total number employed.	Aggregate amount of their net earnings, for the month ending 4th May, 1833.	Number paid by fixed daily wages.	Number paid in proportion to the quantity produced.	Number whose mode of payment is not given in Returns.	
			Males.			Females.								
	Males.	Females	In the direct employ of Masters.	In the direct employ of Operatives.	Employers uncertain.	In the direct employ of Masters.	In the direct employ of Operatives.	Employers uncertain.		£ s. d.				
Manchester and immediate neighbourhood	5,847	7,624	1,734	2,803	63	2,592	1,640	59	22,442*	45,164 9 5	11,690	9,178	1,574	
Stockport & Heaton Norris	2,601	2,525	660	1,027	28	976	541	38	8,396	18,405 5 9¼	3,470	4,764	162	
Duckenfield and Stayley Bridge	2,551	2,421	347	976	9	859	358	25	8,542†	19,409 7 5½	2,693	3,827	2,022	
Hyde, Brinnington, &c.	2,802	3,507	1,076	832	51	1,921	180	13	10,382	23,397 16 10	2,409	6,637	1,336	
Tintwistle, Glossop, &c.	1,321	1,413	233	591	26	423	333	30	4,370	8,884 10 4½	1,796	1,917	657	
Oldham	1,954	1,388	310	882	40	694	389	38	5,695	11,467 9 9¼	2,672	2,806	217	
Bolton	1,650	1,482	383	1,204	3	696	750	6	6,174	11,548 15 7	4,265	1,833	56	
Warrington	334	355	65	150	—	110	88	—	1,102	2,019 4 6¼	348	539	215	
One mill at Bury, and one at Ashton	187	247	72	58	—	127	25	—	716	1,338 5 10½	250	449	17	
	19,247	20,962	4,880	8,[illegible]23	220	8,398	4,304	209	67,819	141,635 5 7	29,613	31,950	6,256	67,819

* Including 80, whose ages and sex were not given in the Returns.

† Including 996, whose ages and sex were not given in the Returns.

TABLE IV.

Distributing the 67,819 persons (in Table III.) into eight different branches or departments of Cotton working, and shewing the Aggregate Net Earnings of the whole number of Operatives in each branch, realized by them during the month ending 4th May, 1833, and other particulars.

Employed in	Adults.		Children under 18 years.						Number of persons whose age and sex are not given in Returns.	Total number of persons employed.	Aggregate amount of their net earnings, for the month ending 4th May, 1833.		
			Males.			Females.							
	Males.	Females.	In the direct employ of Masters.	In the direct employ of Operatives.	Employers uncertain.	In the direct employ of Masters.	In the direct employ of Operatives.	Employers uncertain.			£.	s.	d.
Cleaning and spreading Cotton	424	739	303	1	10	110	2	4	—	1,593	2,750	19	11
Carding	3,302	4,800	1,588	147	25	2,581	146	52	261	12,902	23,990	9	10½
Mule spinning	7,243	1,656	968	7,532	82	400	2,761	26	116	20,784	44,509	13	9¼
Throstle spinning	253	956	149	8	32	702	6	51	—	2,457	3,701	16	10
Reeling	230	3,572	58	8	—	735	24	38	—	4,665	7,271	17	5½
Weaving	6,514	9,104	1,460	823	65	3,859	1,358	38	699	23,920	53,752	17	5¼
Roller covering	83	124	6	1	—	10	7	—	—	231	562	9	6¾
As engineers, mechanics, firemen, &c.	1,198	11	48	3	6	1	—	—	—	1,267	5,095	0	9¾
	19,247	20,962	4,880	8,523	220	8,398	4,304	209	1,076	67,819	141,635	5	7¾

These tables were compiled with the greatest care, from returns which had every appearance of being strictly faithful. The mills from which the returns were made employed a number of operatives varying from 16 up to 1576 in each, and the average number of operatives in each was 292. So far as they go, therefore, these tables may be regarded as presenting an accurate statement of the numbers, earnings, age, sex, and length of employment, of the several classes of operatives in the cotton mills of England: and they afford materials for calculating, with an approximation to accuracy, the whole number of persons employed in the mills, their distinct occupations, their remuneration, and other particulars. It can, however, be only an approximation, as improvements in the machinery are constantly altering the number of workmen employed in each department; and the Factories Regulation Act of 1833 has had the effect of causing thousands of young children to be dismissed, whose place it has in many cases been found unnecessary to supply, as their work can be done by new contrivances with the operatives that are left. The following calculation by Mr. Stanway has reference to the quantity of yarn spun in 1832, and to the state of things in the factories in May, 1833:—

CALCULATION OF THE TOTAL NUMBER OF PERSONS EMPLOYED IN COTTON MILLS IN ENGLAND.

"The subsequent calculation does not aim at fixing the whole number of operatives dependent upon the cotton trade for subsistence, but only of that part of the operative body which earns a livelihood in cotton factories *moved by power*, and is employed

in carrying on the preparing, spinning, weaving, and accessary mechanical departments within the walls of them.

"It does not comprehend the hand-loom weavers, printers, bleachers, dyers, cotton-thread lace-makers, (an enormous and growing branch of the cotton manufacture,) and many other branches of manufacture, either arising out of, or immediately depending upon the spinning of cotton by power. It comprehends those operatives alone who habitually work in cotton factories. It shews their body to consist of 212,800 persons, and to earn annually the enormous sum of £5,777,434. 14s. 1d.

"CALCULATION. The total quantity of cotton consumed in the spinning of yarn in Great Britain in 1832, as stated in *Burn's Commercial Glance*, was 277,260,490 lbs.; and of this quantity 27,327,120 lbs. was consumed in Scotland, leaving for the consumption of England 249,933,370 lbs.

"The net loss of cotton in spinning is estimated variously by different individuals. In the calculations of Mr. Kennedy, made use of by him in a paper published in the "Transactions of the Manchester Literary and Philosophical Society," it is taken at 1½ oz. per lb.; whilst Montgomery, in his "Theory and Practice of Cotton Spinning," computes it at 1⅝ oz., and Burn at 1¾ oz.; but as the amount taken by Mr. Kennedy is that which appears to be generally considered correct, it is adopted in these calculations.

"If, then, from the quantity of cotton given above we deduct 1½ oz. per lb., or 23,431,253 lbs., we shall have the total weight of yarn produced 226,502,117 lbs.

"The average number of hanks in each lb. of yarn spun is considered, by apparently a majority of persons conversant with the subject, to be 40. Montgomery takes the average counts spun in Great Britain at 50s, which, taking into account the finer average numbers spun in Scotland than in England, would fix the counts nearly as above stated.

"The returns made to the Lancashire forms of inquiry, as given in the previous tables, shew an average of finer counts than 40s; but as the returns were better made from the fine mills than from the coarse, and from Manchester, where the finer yarn is spun, than from the country, it is evident that lower numbers ought

to be taken than those shewn in the returns; and, as the general opinion appears to be in favour of 40s, this average is adopted.

"Three mills in different situations, and of *average capabilities*, made a return of the quantity produced by them in the month ending the 4th of May, 1833; and as the average counts of the whole were 39·98 hanks to the lb., and as they also gave the number of the hands employed in spinning during that month, and the duration of their labour, they furnish data from which may be easily calculated the total number employed in factories, in England, in preparing and spinning cotton. In the mill of the first, 344 persons in the spinning department, working 276 hours, produced

18,000 lbs. of 30s to 32s.
18,000 lbs. of 38s to 42s.
2,400 lbs. of 150s to 170s.

In the second mill, 245 hands, working 270 hours, produced

1,795 lbs. of 12s.
4,285 lbs. of 22s.
33,838 lbs. of 40s.

And in the third, 110 hands, working 286 hours, produced

16,700 lbs. of 40s.

"The average counts of the three being, as before stated, 39·98 and the produce 95,018 lbs.

"The total number of hours worked will, therefore, be $\overline{344 \times 276} + \overline{245 \times 270} + \overline{110 \times 286} = 192,554$; and the produce of each person per hour $\frac{95,018}{192,554} = \cdot 49,346$ lb.

"The usual estimate of 300 working days per annum, of 11½ hours each, or 69 hours per week, would give—$\cdot 49,346 \times 11\cdot 5 \times 300 = 1,702\cdot 437$* lbs., the produce of each person per annum, and $\frac{226,502,117}{1,702\cdot 437} = 133,045$, the number of persons employed in the preparation and spinning of cotton in England.

* In the Report, the number 1,702·437 (including a decimal) is erroneously printed in two places thus—1,702,437; which increases the sum a thousand fold.

"On an examination of Supplement Z, (Table IV. *ante*,) it will be seen that in the 67,819 persons of whom returns were made to the Commission, there were 42,401 engaged in preparing and spinning cotton, 23,920 in the weaving department, and 1498 as engineers, mechanics, roller-coverers, &c.

"If, then, the same proportions are taken as existing in the total number of cotton-workers which are found in the returns made to the Lancashire Forms of Inquiry, the number of persons engaged in the manufacture of cotton-cloth in factories will be 75,055, and of those employed as engineers, &c. 4700; making, with the 133,045 in the spinning department, a general total of 212,800 persons engaged in cotton factories.

"Which total number of 212,800 persons may be divided and distributed, by adopting the proportions given in the returns made to the Lancashire Forms of Inquiry, so as to shew the probable number of persons employed in each of the Eight Branches or Departments of Cotton Working, and the aggregate amount of their Net Earnings per month:"—

TABLE V.

Estimated Number of persons employed in the Cotton Mills of England, distinguishing Ages, Sex, description of Labour, and Monthly Net Earnings.

Employed in	Adults. Males.	Adults. Females	Children under Eighteen Years. Males. In the direct employ of Masters	Children under Eighteen Years. Males. In the direct employ of Operatives.	Children under Eighteen Years. Males. Employers uncertain.	Children under Eighteen Years. Females. In the direct employ of Masters	Children under Eighteen Years. Females. In the direct employ of Operatives.	Children under Eighteen Years. Females. Employers uncertain.	Proportion whose Age & Sex are uncertain from a deficiency in the Returns.	Total number employed.	Aggregate Amount of Monthly Net Earnings. £. s. d.
Cleaning and spreading Cotton	1,330	2,319	951	3	31	345	6	13	—	4,998	8,631 19 6
Carding	10,361	15,062	4,983	461	78	8,099	458	163	819	40,484	75,276 10 0
Mule-spinning	22,727	5,196	3,038	23,634	257	1,255	8,663	82	364	65,216	139,660 17 9
Throstle-spinning	793	3,000	1,409	25	100	2,203	19	160	—	7,709	11,615 10 1
Reeling	722	11,208	182	25	—	2,306	76	119	—	14,638	22,817 8 4
Weaving	20,440	28,566	4,581	2,582	204	12,109	4,261	119	2,193	75,955	168,663 16 3
Roller covering	261	389	19	3	—	31	22	—	-	725	1,764 18 5
As Engineers, Mechanics, &c.	3,759	34	151	9	19	3	—	—	—	3,975	15,987 0 0
	60,393	65,774	15,314	26,742	689	26,3[illegible]1	13,505	656	3,376	212,809	444,181 1 1

By the same mode of calculation, Mr. Stanway found that of the 83,257 children under eighteen years of age, there would be 24,665 boys and 19,038 girls under fourteen years, and 18,080 boys and 21,474 girls between fourteen and eighteen. The number under ten years of age would be 4234 boys and 2901 girls. He thus concludes his calculation—

"The total net earnings per annum of the whole estimated number of 212,800 persons will be £5,777,434. 14s. 1d.

"And since the proprietors of the mills included in the three lists previously given, employing 67,819 hands, employ also 183 persons in the counting-houses, and 1147 in the warehouses, (within the mills,) adopting these proportions, there will be employed, with reference to the total number of 212,800 persons engaged in factories, an additional number of 574 clerks and 3599 warehouse hands."

The above calculation is for England alone: it shews 216,973 persons to be employed in the cotton factories.

More than one-third of the mill operatives in England are children, half of whom are under 14 years of age; yet the wages of the whole, men, women, and children, average within a fraction 10s. 6d. per week.

The correctness of the total estimated number of operatives in the spinning mills will be seen to depend upon one point, namely, the quantity of yarn taken as produced by each operative within a given time: if that point is exactly ascertained, the whole quantity of yarn produced in England in a year being known, it is easy to calculate how many operatives will be required to produce it. Mr. Stanway finds, from the returns of three mills "of average capabilities," that the quantity of yarn of the average number (40s) produced by each operative is nearly ½ lb., or the decimal ·49,316 lb. in

the hour, which would make about 5⅔ lbs. (5·67,479 lbs.) per day, or 227 hanks of 40 hanks to the lb. Mr. Kennedy conducted his calculation in 1817 on similar principles, but he assumed a lower production for each workman, even allowing for the improvement that has since taken place in machinery. He assumed that each operative produced 120 hanks, of No. 40, per day. From Mr. Kennedy's table, shewing the comparative cost of yarn in 1812 and 1830, (quoted at p. 353,) it appears that, owing to improvements in the machinery, 1 lb. of No. 40, which cost 1s. for labour in 1812, cost only 7½d. for labour in 1830, or, in other words, labour had become more productive in the proportion of 1s. to 7½d., or of 8 to 5. If we suppose the same improvement in machinery between 1817 and 1833 as between 1812 and 1830, a workman who produced 120 hanks per day in 1817 ought to produce 192 hanks in 1833. But Mr. Stanway's calculation makes the workman produce 227 hanks. The difference is considerable; and as Mr. Kennedy's two tables would lead us to estimate the productive power of the workman as less than Mr. Stanway's, they would, of course, show a greater number of workmen to be necessary for the production of the same quantity of yarn. If a productive power of 227 hanks per day for each man would require 133,015 workmen, to produce the quantity of yarn spun in England in the year, a productive power of only 192 hanks per day would require 157,298 workmen. Mr. Stanway has therefore erred, if at all, on the side of moderation, in his estimate of the number of workmen.

The returns above quoted shew not only the number of operatives engaged in the spinning, but also those

engaged in weaving by power-looms and in the accessory departments. Of 67,819 operatives employed in 225 mills, 23,920 were power-loom weavers, warpers, dressers, and overlookers in these departments. Were the same proportion to hold in all the other cotton mills, 75,055 persons would be engaged in the departments connected with power-loom weaving in England. But Mr. Stanway's calculation proceeds on returns comprising less than one-third of the English cotton mills, and as those returns include the large mills in Manchester and the neighbourhood, where power-loom weaving is more generally introduced than among the spinners in country places, it is probable the same proportion would not hold throughout. Instead of multiplying the number actually returned, 23,920, by 3 1/7th, as Mr. Stanway has done, I am disposed to multiply it by 2, which would shew the number of workmen engaged in weaving, &c. in the mills in England to be 47,840, (instead of 75,055, calculated by Mr. Stanway.) Add to these 9000 for the operatives engaged in connexion with the power-loom in Scotland, and the total number in Great Britain will be, at a low (perhaps too low) computation, 56,840.

The above elements will assist us to estimate the number of power-looms in England and in Great Britain. Two looms are managed by each weaver; but of the 47,840 operatives mentioned above, as employed in England, only 41,418 are weavers, the rest being engaged in dressing and warping.* Twice 41,418, therefore, 82,836, shews the number of power-looms in

* I find this proportion by taking out the warpers, dressers, and overlookers in the weaving department, in ten different local returns, contained in the Supplementary Report of the Factory Commission, part I. p. 125 133, and comparing

England; and add to them 15,000, the ascertained number in Scotland, there will be 97,836 power-looms in Great Britain. This calculation is founded on the quantity of yarn produced in 1832. Messrs. Samuel Greg and Co., the extensive spinners and manufacturers, of Bury, &c., estimated the power-looms in England and Scotland in 1833 at from 80,000 to 90,000.† Mr. Bannatyne supposes that the number in Lancashire in 1832 was 80,000.‡ Mr. Kennedy had formed a lower estimate, but he has recently stated that these machines have increased beyond his means of estimating them. It is certain that the number is constantly and rapidly growing, and that the machine-makers have generally more orders for them than they are able to execute. We cannot be wrong in saying that there are now at least 100,000 power-looms in Great Britain, —85,000 in England, and 15,000 in Scotland.

I have in a former chapter adduced evidence, which would lead to the conclusion that there are in England alone 200,000 hand-looms in the cotton manufacture; and if to these are added the 82,836 power-looms, we shall have a total of 282,836 looms in this manufacture in England, which is nearly one-third more than the estimate of Mr. Burn, quoted at page 368. In Great Britain the number of hand-looms, according to the best evidence I can find, is 250,000, and of power-looms 100,000,—total of cotton looms, 350,000.

There are a few hundred power-looms and some

their numbers with that of the workpeople actually engaged in managing the power-looms: the proportion which these auxiliaries bear to the weavers is 1 to 6½.

† Report quoted in the last note, p. 192.

‡ Encycl. Britannica, art. "Cotton Manufacture."

thousands of hand-loom weavers in Ireland: as their number has never been ascertained, they are not included in the above estimate, but they would not materially swell the number in Great Britain.

Since the foregoing part of this chapter was in type, I have received a body of statistical information concerning the cotton mills of the United Kingdom, which, though not complete, is highly valuable, as being the first ever obtained from *actual returns*. Mr. Stanway's calculation was indeed founded on returns, but they comprised less than one-fifth of all the cotton mills in the kingdom; whereas those which I have received are nearly complete as to the number of mills, and from a large proportion of them returns have been made of the workmen employed, and the amount of steam and water power by which the mills are moved.

The inspectors of factories, Robert Rickards, Esq. Leonard Horner, Esq., Robert J. Saunders, Esq. and Thomas Jones Howell, Esq. have obligingly furnished me with the information they have acquired on these points in their respective districts; and as they have visited the mills in person, or by their superintendents, and have obtained regular returns from most of the mill-owners in the course of the present year, their information may be relied upon as far as it extends. In the largest and most important manufacturing district, that of Mr. Rickards, comprising Lancashire, the West Riding of Yorkshire, Cheshire, the High Peak Hundred of Derbyshire, part of Staffordshire, and the four northern counties of Wales, it will be seen that the returns are imperfect: they include nearly the whole number of mills, but 241 out of 934 mills have not returned the hands and power employed. The returns

of Mr. Horner, whose district comprehends all Scotland, the four northern counties of England, and the northern half of Ireland, appear to be as complete and precise as can ever be expected. Those of Mr. Saunders, comprising the eastern, southern, half the central, and half the western counties of England, are also tolerably complete. The district of Mr. Howell, including half the central and western counties of England, the eight southern counties of Wales, and the southern half of Ireland, yields very few cotton mills, and is probably the most exact of any in its returns.

The following are the returns furnished by Mr. Rickards, with the assistance of his superintendent, Mr. Heathcote:—

COTTON MILLS in the District assigned to ROBERT RICKARDS, Esq. Factory Inspector, viz. Lancashire, the West Riding of Yorkshire, Cheshire, the High Peak Hundred of Derbyshire, the north of Staffordshire, and the four northern Counties of Wales.

COTTON MILLS IN LANCASHIRE.

Towns, &c.	No. of Mills.	Horse Power. Steam.	Horse Power. Water.	Total number of Persons employed.
Manchester A	19	1059	10	6335
... B	21	1145	None	8578
... C	21	1266		7796
... D	16	817		5178 *
... E	21	934		4802
Bolton A	29	921	156	6002
... B	27	696	359	5299
Leigh	10	253	None	1291
Ashton Mackerfield	1	88	None	390
Warrington	9	210	None	1352
Wigan	21	911	None	1831
St. Helen's	1	40	6	150
Over Darwen	7	62	70	613
Blackburn	13	621	40	4537
Chorley	10	225	20	1178
Preston	31	1012	60	6665
Garstang	2	7	38	181
Lancaster	8	180	68	1515
Ulverstone	4	22	133	174
Rochdale	38	1021	151	4296
Ashton-under Lyne	35	1200	33	8396
Stayley Bridge	21	1111	105	7376
Haughton	4	97	25	1055
Heap	31	801	160	1167
Ramsbottom	11	178	217	1533
Haslingden	20	105	146	1679
Burnley	17	355	26	2019
Accrington	10	91	82	727
Colne, &c.	11	119	136	1677
Bury	27	[illegible]	119	5567 *
Rochdale, Todmorden, &c.	63	2022	278	12,090 *
Oldham, &c.	89	2856	[illegible]	18,352 *
Total	657	21387	2831	137,352

* The asterisks indicate that in these lines the returns are not complete, except as to the number of the mills: all the numbers printed in figures of a smaller size are merely *estimates:* that for division D in Manchester is formed by taking an average of all the other mills in that town, and multiplying the average by the number of mills in that division. The estimate of the hands, &c. in the mills at Bury, the Rochdale and Todmorden district, and the Oldham district, is formed by taking an average of all the other mills in the county, and multiplying it by the number of mills from which there are no returns.

Cotton Mills in Yorkshire.

Towns, &c.	No of Mills.	Horse Power. Steam.	Horse Power. Water.	Total number of Persons employed.
Sedbergh	2	none	50	198
Ingleton	3	20	40	186
Birstwith	1	none	40	88
Grassington	3	none	27	130
Kettlewell	2	none	11	38
Skipton	6	90	61	605
Gargrave	4	6	54	149
Addingham	2	none	65	288
Bingley	2	20	75	271
Ditto	3	21	48	161
Keighley, part	8	30	80	253
Haworth	2	none	32	65
Otley	1	none	100	380
Birstall	1	15	none	85
Ossett	1	36	none	80
Mirfield	1	none	60	170
Settle	5	30	47	333
Barnoldswick	5	20	24	172
Meltham	1	88	30	650
Saddleworth	11	119	11½	819
Halifax, part of parish	13	232	250	2178
Huddersfield	4		28	193
Barrowford	5			
Soyland	8			
Rishworth	3			
Barkisland	2	199	296	1958*
Skircoat	2			
Ovenden	1			
Northowram	1			
Keighley, part of	4			
Total	140	956	1,129½	9453

* Returns have not been received from these mills; and the number of hands, &c. is estimated from the average of all the other mills in the county.

Cotton Mills in Cheshire.

Towns, &c.	No. of Mills.	Horse Power. Steam.	Water.	Total number of Persons employed.
Congleton . . .	2	18	10	154
Bollington . . .	11	214	221	2017
Hyde	15	1048	216	7050*
Stockport . . .	38	1529	97	5119†
Mottram	12	140	141	1016‡
Disley	2	24	75	494
Nantwich . . .	1	36	36	110
Total . .	71	3039	802	19,630
Estimate for the four mills not returned .		171	45	1106
Total . .		3210	817	20,756

* One large mill left out—no return.
† No return of water-power from Park Mill.
‡ Three mills left out of returns.

Cotton Mills in the North of Staffordshire, Denbighshire, and Flintshire.

Counties.	No. of Mills.	Horse Power. Steam.	Water.	Total number of Persons employed.
Staffordshire, (northern part) .	4	284	65	1876*
Denbighshire . .	1			
Flintshire . . .	5			
Total . .	10	284	65	1876

* Returns have not been received from any of the mills: the number of hands and horse-power is estimated from the average of all the other mills in Mr. Rickards's district.

Cotton Mills in the High Peak Hundred of Derbyshire.

Towns, &c.	No. of Mills.	Horse Power.		Total number of Persons employed.
		Steam.	Water.	
Glossop . . . . Hayfield . . . . New Mills . . . Chapel Firth . . Litton, &c. . .	54	622	873	5543
Brough	2	34	48	308 *
Castleton . . .	1			
Total	56	676	921	5,851

* Returns have not been received; an estimate is given.

Summary.

Counties, &c.	No of Mills.	Horse Power.		Total number of Persons employed.
		Steam.	Water.	
Lancashire	657	21,387	2831	137,352
Yorkshire	110	956	1429½	9,453
Cheshire . . .	71	3210	847	20,736
Derbyshire, (High Peak Hundred)	56	676	921	5,851
North of Staffordshire, Denbighshire, and Flintshire . . .	10	284	65	1,876
Total . .	934	26,513	6,093½	175,268

COTTON MILLS in the district assigned to LEONARD HORNER, Esq. Factory Inspector, viz. the whole of Scotland, the northern half of Ireland, the counties of Northumberland, Cumberland, Durham, and parts of Westmorland and Yorkshire.

Counties and Towns.	Description of work in Mills.	Number of Mills.	Horse Power.		Total persons of all ages employed.	Between 13 & 18 years of age	Under 13 years of age [cut off]
			Steam.	Water.			
SCOTLAND.							
LANARKSHIRE.							
Glasgow	Cotton spinning	21	781	9	5143	1601	97
	Cotton spinning & weaving	11	539		3819	1117	33
	Cotton weaving	30	831	6	5799	1433	14
	Cotton spinning & silk throwing	1	10		100	50	2
	Cotton spinning for thread	2	85		490	[illegible]	6
PERTHSHIRE.							
Stanley	Cotton spinning & weaving	1		200	850	275	16
LANARKSHIRE, BUTE, & DUMBARTONSHIRE.							
Lanark	Cotton spinning	1		300	910	180	3
Duntocher	Ditto	1	40	80	370	100	5
Pothsay	Ditto	1		60	436	158	8
Blantyre	Cotton spinning & weaving	1	55	150	849	209	11
Airdrie	Ditto	1	60		200	60	4
Busby	Ditto	1		55	321	63	4
Duntocher	Ditto	1	50	160	958	281	14
Rothsay	Ditto	1	10		63	17	:
Luss	Cotton and Wool spinning	1		4	11	6	:
STIRLINGSHIRE.							
Ballindalloch	Cotton spinning	1	16	40	241	60	3
Culcreuch	Ditto	1		35	228	59	3
Milngavie	Ditto	1	10	15	125	45	1
Deanston	Cotton spinning & weaving	1		300	783	213	19
RENFREWSHIRE.							
Paisley	Cotton spinning	26	322	480	4974	1586	73
	Cotton weaving	3	28	10	288	70	2
	Cotton spinning, thread	5	72		449	136	4
	Cotton spinning & weaving	4	70	66	888	304	11
AYRSHIRE.							
Catrine	Cotton weaving & spinning	1	80	200	817	120	13
Beith	Ditto	1		2	6	1	[illegible]
LINLITHGOWSHIRE.	Cotton spinning	1	16	20	97	29	2
ABERDEENSHIRE	Ditto	2	107		763	313	14
	Cotton spinning & weaving	1		250	591	160	10
DUMFRIESSHIRE.	Cotton spinning	1	18	18	108	36	1
WIGTONSHIRE.	Cotton spinning & weaving	1		20	92	15	[illegible]
Total		125	3200	2180	31,099	9002	38

COTTON MILLS in the district of LEONARD HORNER, Esq. (*continued.*)

Counties and Towns.	Description of Work in Mills.	No. of Mills.	Horse Power. Steam.	Horse Power. Water.	Total Persons of all ages employed.	Between 13 & 18 Years of age.	Under 13 Years of age.
IRELAND.							
ANTRIM.	Cotton spinning	7	125	114	977	294	81
	Cotton spinning and weaving	2	91	25	567	125	49
	Do. with flax spinning . .	1	90		555	209	77
ARMAGH.	Cotton spinning and weaving	1		30	196	61	36
DOWN.	Cotton spinning	2	26		230	57	40
	Cotton spinning and weaving	1	40	50	282	102	29
DERRY.	Cotton spinning	1		15	82	40	4
		15	372	234	2889	888	316
ENGLAND.							
CUMBERLAND.							
Carlisle .	Cotton spinning and winding	12	98	78	1635	558	118
SUMMARY.							
SCOTLAND		125	3200	2480	31,099	9002	3889
NORTH OF IRELAND . .		15	372	234	2,889	888	316
ENGLAND (CUMBERLAND)		12	98	78	1,635	558	118
Grand Total . .		152	3670	2792	35,623	10,448	4323

COTTON MILLS in the District assigned to ROBERT J. SAUNDERS, Esq. Factory Inspector, comprising the Eastern, Southern, Half the Central, and Half the Western Counties of England.

Counties and Towns.	Description of Work in Mills.	No. of Mills.	Horse Power.		Total Persons of all ages employed.
			Steam.	Water.	
NOTTINGHAMSHIRE and DERBYSHIRE.					
Mansfield and neighbourhood	Cotton spinning for Hosiery	8	70	Doubtful	1000 to 1100
Cromford, Belper, and Ashbourne	Do. . . .	6	20	500	2600 by day, 50 by night.
Derby and neighbourhood . .	Do.	2		280	700 to 800
Nottinghamshire and Derbyshire	Spinning candle-wick yarn . .	3	85	Doubtful	350
Nottingham and neighbourhood	Doubling yarn for lace	7	92	48	700
Mansfield, Chesterfield, & neighbourhood . . .	Do.	7	48	45	440 to 450
Derby and neighbourhood . . .	Do.	4	28	40	350 by day 128 by nigh
Measham	. . . .	3			
Tansley	. . . .	1			
Wirksworth . . .	Power-loom weaving, tapes, bobbins, &c.	1	16	59	480 to 500
STAFFORDSHIRE.					
Tamworth	. . . .	2			
Tamworth, Burton-upon-Trent, and neighbourhood	Cotton spinning & weaving . . .	6	45	200	900
MIDDLESEX.					
London and neighbourhood	Spinning candle-wick yarn . .	4	44	Doubtful	300 to 330
		54	438	1172*	8128 mediu

* In this addition the mills whose water-power is "doubtful" are altogether excluded.

N. B. In the above mills, containing 8,128 work-people, 3,250 are young persons between the ages of 11 and 18, and 320 a. Children aged from 9 to 11.

In addition to the above total of 54 mills, there are 11 others connected with the cotton trade in this district. Some of these are just commencing work; others are closed under temporary circumstances; and some are employed in the fancy trade, where cotton-yarn and worsted-yarn are wove together, or in the spinning of Angola, where cotton and wool are spun together. None of these mills are included in the above table.

COTTON MILLS in the District assigned to THOMAS JONES HOWELL, Esq. including half the Central and Western Counties of England, the Eight Southern Counties of Wales, and the Southern half of Ireland.

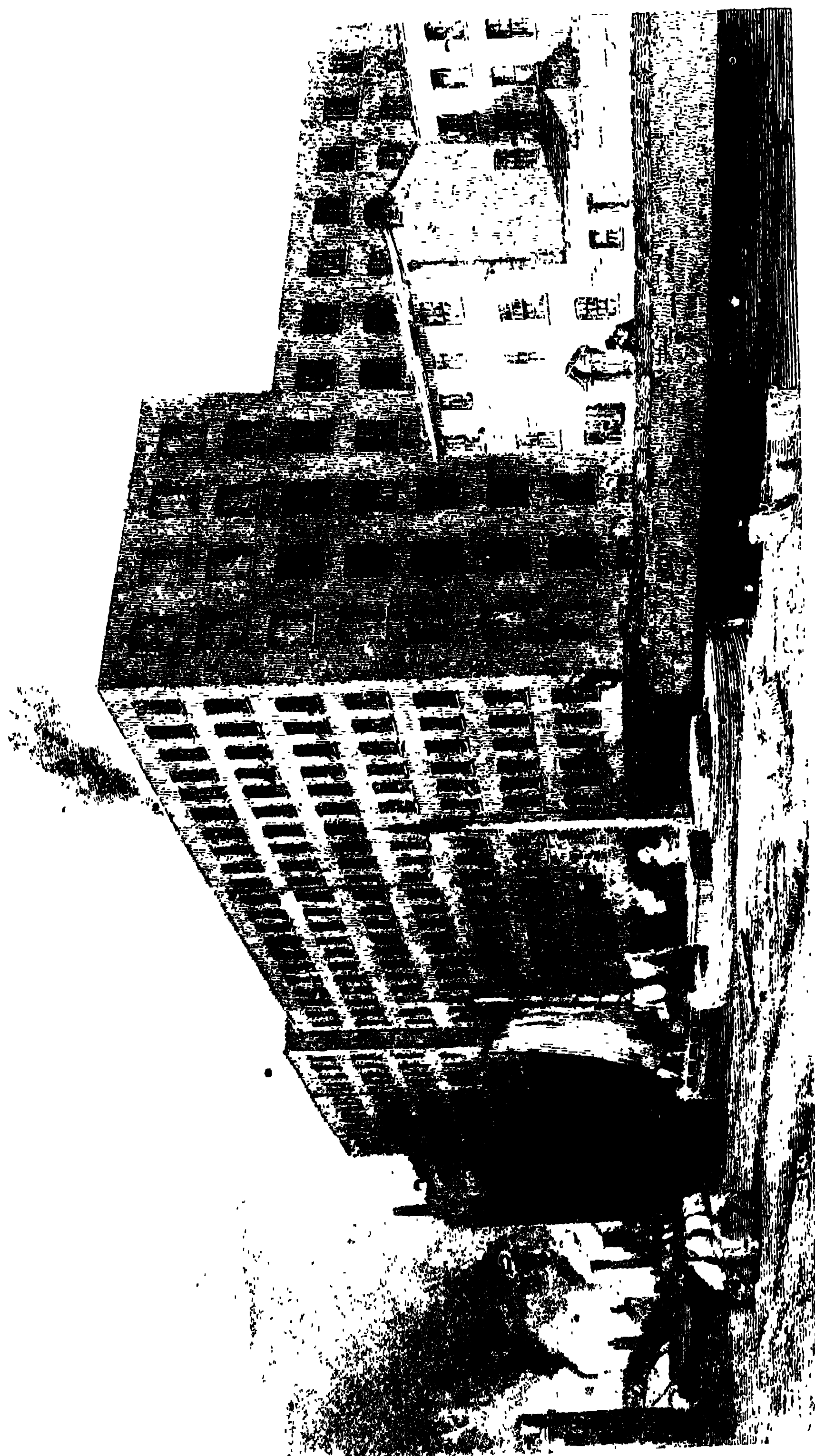
Counties.	No. of Mills.	Men employed.	Women employed.	Children employed.	Total number of Persons employed.
DUBLIN	7	185	230	95	510
KILDARE	2				
QUEEN'S COUNTY .	2				
WEXFORD	1	416	593	257	1296
WATERFORD	1				
CORK	1				
Total	14	631	823	352	1806

N.B. In the English and Welsh counties under Mr. Howell's superintendence, there are no cotton mills. The moving power in the mills has not yet been returned to Mr. Howell; but if we suppose the power employed in the mills of the south of Ireland to bear the same proportion to the number of work-people as in the north of Ireland, (where we have Mr. Horner's return,) the mills in Mr. Howell's district would be moved by 232 horse-power of steam and 146 of water.

GRAND SUMMARY
OF COTTON MILLS IN THE UNITED KINGDOM.

Districts of Factory Inspectors.	Number of Mills.	Horse Power.		Number of Persons Employed.
		Steam.	Water.	
Mr. Rickards's	934	26,513	6,093½	175,268
Mr. Horner's	152	3,670	2,792	35,623
Mr. Saunders's	54	438	1,172	8,128
Mr. Howell's	14	232	146	1,806
Total..........	1,154	30,853	10,203½	220,825
In ENGLAND & WALES	1000	27,049	7,343½	185,031
In SCOTLAND	125	3,200	2,480	31,099
In IRELAND	29	604	380	4,695
Total in the United Kingdom	1,154	30,853	10,203½	220,825

The above returns are avowedly incomplete as regards the districts of Mr. Rickards and Mr. Saunders. In the former, I learn from the Inspector that he is convinced he has not yet received an account of all the mills; and it will be seen that, owing to the incompleteness of the returns from the mills known to the Inspectors, several of the numbers have been supplied by estimate. In Mr. Saunders's statement, several mills in which cotton is worked are omitted, from the causes assigned. In Mr. Horner's statement, at least one mill (in the north of Yorkshire) is omitted. We shall probably not err on the side of excess, if we take the operatives in the cotton mills of England and Wales (instead of 185,031) at 200,000, those of Scotland at 32,000, and those of Ireland at 5,000;—total 237,000. These mills are moved by power about equal to that of 44,000



horses, of which 33,000 horse-power is that of steam-engines, and 11,000 is that of water-wheels.

It must be remarked, that this result, obtained for the greatest part from actual returns, corresponds very closely with Mr. Stanway's calculation, after deducting the supposed excess in his estimate of the number of power-loom weavers. His estimate, reduced on this account, would make the number of mill operatives in England 195,585. The near approximation of the numbers justifies confidence in their general accuracy.

The following table shews the increase in the number of mills in the townships of Manchester and Salford, within twelve years:—

NUMBER OF COTTON MILLS AT WORK IN THE TOWNSHIPS OF MANCHESTER AND SALFORD, IN DIFFERENT YEARS.

	1820	1823	1826	1829	1832
Manchester..........	44	49	63	63	68
Salford	4	5	10	10	7
Chorlton on Wedlock	12	12	12	13	12
Ardwick ..	2	2	2	3	3
Hulme....	2	2	2	2	2
Newton ..	..	..	1	1	1
Pendleton	2	2	2	2	2
Beswick ..	..	..	..	1	1
Total	66	72	92	95	96

There are three other great branches of the cotton manufacture, in which we possess some means of estimating the number of workmen employed. In the

lace-making and embroidering, it has been seen that Mr. Felkin estimates the number of hands employed at 159,000; and in the cotton hosiery, the same gentleman estimates the hands at 33,000.

An estimate has been given, at p. 284, of the wages paid to the operative calico printers, which amounted in 1830 to £1,000,000 a year, or £19,230 a week. Supposing the average wages of the adults and children in this line to be 10s. a week,* the number of hands would be 38,460. But this was in 1830, since which time the repeal of the excise duty has considerably extended the printing trade; and we may probably assume 45,000 men, women, and children, to be now engaged in that trade.

If, then, we take the number of the workmen employed in the spinning and weaving factories of the United Kingdom, as above given, and the other classes of workmen whose number has been estimated, we shall have before us the following calculations of the hands employed in several great branches of the British cotton manufacture, viz.

In the spinning and weaving factories .	237,000
In hand-loom weaving	250,000
In the lace-making and embroidery . .	159,000
In the hosiery	33,000
In calico-printing	45,000

These would make 724,000: but, in addition to these, there are the bleachers, the dyers, the calenderers, the

* The average wages paid to the hands in the print-works of Messrs. Thomson and Chippendale, Clitheroe, were stated by Mr. Thomson to the Committee on Manufactures (Report, p. 222) to be 12s. 3d. per week; but, this being an establishment of the first class, where the finest work is done, and the best wages paid, probably the average wages of all the print-works would not exceed 10s.

fustian-cutters, the sizers, the winders and draw-boys for the hand-loom weavers, the embroiderers of muslins, the machine-makers, the engravers and designers, the makers of steam-engines; cards, rollers, spindles, shuttles, jennies, looms, &c. &c.; there are all those engaged in the mercantile department in Manchester, Glasgow, and other places, with their clerks and warehousemen; there are the classes engaged in the packing department, namely, the packers, paper makers, canvass manufacturers, trunk and packing-case makers, &c.; there are the seamen by whom the cotton is imported and the manufactured goods are exported, the carriers by land and water in this country, the porters, &c. There are also considerable numbers of men constantly employed in building the mills and warehouses required for carrying on the manufacture. If all these, most of whom may be regarded as directly employed in the manufacture, could be enumerated, they would swell to an enormous amount. And if we should add those who are employed in aid of the manufacture, namely, the cotton growers in America, India, Brazil, &c.; the workmen in this country who provide the metals, timber, leather, coal, bricks, stone, &c., used for buildings, machinery, implements, and fuel; the agriculturists who grow food for the manufacturing population, and the tradesmen who provide them with the necessaries of life; all of whom are unquestionably supported by the cotton manufacture of Great Britain, and would be thrown out of bread by its failure; the importance of this vast branch of productive industry would then rise in our estimation to its just magnitude, and would much exceed the calculations usually made

of the capital it employs and the population it maintains.

But as it is impossible to estimate with even an approach to accuracy many of the classes last mentioned, it is usual to comprise only those more directly engaged in the manufacture, in the calculations made of its extent and value. One mode of calculating the number of workmen, is to take the whole value of the goods produced, as nearly as it can be ascertained, and divide it into cost of raw material, profits of capital, and wages of labour; then to form an average of the workmen's wages, and to see how many workmen the whole amount paid for labour will remunerate. The ground of this calculation is the "real or declared value" of the cotton goods exported, as entered in the books of the Custom-house; together with a universal opinion that the value of the goods consumed at home nearly equals that of the exports. Another mode of calculation is to ascertain the quantities of each different kind of goods exported, and to assume an average price per yard or per lb.: the value of the whole exports may be thus estimated, and this, being nearly doubled, would shew the entire value of the manufacture. The former of these methods has been pursued by Mr. M'Culloch, in the *Edinburgh Review*, and subsequently in his *Dictionary of Commerce*, the second edition of which contains a careful revision and modification of his estimate.* The latter method is that of Mr. Burn, in his *Commercial Glance*.

* In the first edition of his "Dictionary," Mr. M'Culloch estimated the annual value of the manufactured goods at £36,000,000, and the amount of the capital employed at £56,000,000. In the second edition he has reduced the annual value to £34,000,000, and the capital also to £34,000,000.

Mr. M'Culloch assumes the annual value of the manufactured goods to be £34,000,000; which he founds partly on the estimate of the late Mr. Huskisson, who in 1823 stated the whole value of the cotton manufacture of the United Kingdom to be *thirty-three millions and a half;* and partly on the "real or declared value" of the cotton exports, which was £19,428,664 in 1830, £17,257,204 in 1831, and £17,398,392 in 1832. In this estimate he has the concurrence of Mr. Dugald Bannatyne, who, in the *Encyclopædia Britannica,* calculates the value of the manufactured goods at £34,000,000 a year. Mr. M'Culloch then proceeds as follows:—

"The average annual quantity of cotton wool imported, after deducting the exports, may be taken at about 260,000,000 lbs. weight. It is supposed, that of this quantity about 20,000,000 lbs. are used in a raw or half-manufactured state, leaving a balance of 240,000,000 lbs. for the purposes of manufacturing, the cost of which may be taken, on an average, at 7d. per lb. Deducting, therefore, from the total value of the manufactured goods, or £34,000,000, the value of the raw material amounting to £7,000,000, there remains £27,000,000; which of course forms the fund whence the wages of the persons employed in the various departments of the manufacture, the profits of the capitalists, the sums required to repair the wear and tear of buildings, machinery, &c., the expense of coals, &c. &c., must all be derived. If, then, we had any means of ascertaining how this fund is distributed, we should be able, by taking the average of wages and profits, to form a pretty accurate estimate of the number of labourers, and the quantity of capital employed. But here, unfortunately, we have only probabilities and analogies to guide us. It may, however, be confidently assumed, in the first place, that in consequence of the extensive employment of highly valuable machinery in all the departments of the cotton manufacture, the proportion which

the profits of capital, and the sum to be set aside to replace its wear and tear, bears to the whole value of the manufacture, must be much larger than in any other department of industry. We have heard this proportion variously estimated at from a fourth to a half of the total value of the manufactured goods, exclusive of the raw material; and, as the weight of authority seems to be pretty much divided on the subject, we shall take an intermediate proportion. Assuming, therefore, that the profits of the capital employed in the cotton manufacture, the wages of superintendence, &c., the sum required to replace the wear and tear of machinery, buildings, &c., and to furnish coals, &c., amount together to *one-third* of the value of the manufactured goods, exclusive of the raw material, or to £9,000,000; a sum of £18,000,000 will remain as the wages of the spinners, weavers, bleachers, &c., engaged in the manufacture; and taking, inasmuch as a large proportion of children under sixteen years of age are employed, the average rate of wages at only £22. 10s. a year, we shall have (dividing 18,000,000 by 22·5) 800,000 as the total number of persons directly employed in the different departments of the manufacture.

"We should mistake, however, if we supposed that this number, great as it certainly is, comprised the whole number of persons to whom the cotton manufacture furnishes subsistence, exclusive of the capitalists. Of the sum of £9,000,000, set apart as the profit of the capitalists, and the sum required to furnish coal, and to defray the wear and tear of machinery, &c., a large proportion must annually be laid out in paying the wages of engineers, machine-makers, iron-founders, smiths, joiners, masons, bricklayers, &c. It is not easy to say what this proportion may amount to; but taking it at a *third*, or £3,000,000, and supposing the rate of wages of each individual to average £30 a year, the total number employed in the various capacities alluded to, will be (3,000,000 divided by 30) 100,000, and a sum of £6,000,000 will remain, to cover the profits of the capital employed in the various branches of the manufacture, to repair the different parts of the machinery and buildings as they wear out, and to buy coal, flour, &c. The account will, therefore, stand as follows:—

		£.
Total value of every description of cotton goods annually manufactured in Great Britain . .		34,000,000
Raw material, 240,000,000 lbs. at 7d. per lb.	£7,000,000	
Wages of 800,000 weavers, spinners, bleachers, &c. at £22. 10s. a year each	18,000,000	
Wages of 100,000 engineers, machine-makers, smiths, masons, joiners, &c. at £30 a year each	3,000,000	
Profits of the manufacturers, wages of superintendence, sums to purchase the materials of machinery, coals, &c. . .	6,000,000	
	————	34,000,000

"The capital employed may be estimated as follows :—

Capital employed in the purchase of the raw material	4,000,000
Capital employed in the payment of wages . . .	10,000,000
Capital invested in spinning-mills, power and hand-looms, workshops, warehouses, stocks on hand, &c.	20,000,000
	£34,000,000

"Now, this sum of £34,000,000, supposing the interest of capital, inclusive of the wages of superintendence, &c. to amount to 10 per cent., will yield a sum of £3,400,000, which, being deducted from the £6,000,000 profits, &c. leaves £2,600,000 to purchase materials to repair the waste of capital, the flour required for dressing, the coals necessary in the employment of the steam-engines, to effect insurances, and to meet all other outgoings.

"The aggregate amount of wages, according to the above estimate, is £21,000,000; but there are not many departments of the business in which wages have to be advanced more than six months before the article is sold. We therefore incline to think that £10,000,000 is a sufficient (perhaps too great) allowance for the capital employed in the payment of wages.

"If we are nearly right in these estimates, it will follow—allowance being made for old and infirm persons, children, &c., dependent on those who are actually employed in the various departments of the cotton manufacture, and in the construction,

repair, &c. of the machinery and buildings required to carry it on—that it must furnish, on the most moderate computation, subsistence for from 1,200,000 to 1,400,000 persons!"*

The point of greatest importance in this calculation is the assumed value of the whole manufacture, viz. £31,000,000. If this should be invalidated, the calculation founded upon it would be worthless. Mr. Huskisson and Mr. M'Culloch founded their estimate chiefly on the "real or declared value" of the exports, recorded in the books of the Custom-house. Mr. Burn altogether disregards this as a criterion, makes his estimate quite independently of it, and arrives at a very different conclusion. As will soon appear, he estimates the value of the exports several millions below the "real or declared value:" and Mr. Kennedy adopts Mr. Burn's calculation, thereby giving it the sanction of his authority. But I cannot see the reasonableness of wholly neglecting a record of value resting on the testimony of the exporters, who must be the best judges. The exporters have no motive for declaring the value of the cotton goods at the Custom-house to be either more or less than it actually is, as there is neither duty to be paid, nor drawback or bounty to be received. There is at some of the ports a loose manner of making these declarations; but even there it is most improbable that the declarations should be always very greatly over the value; and at the ports of Liverpool and London there is reason to believe that the declarations approach very near the actual value.

* In a former part of this work I have supposed, with Mr. M'Culloch, that the number of individuals to whom the cotton manufacture affords subsistence is from 1,200,000 to 1,400,000 persons; but further examination leads me to conclude that the number cannot be less than 1,500,000.

I have made careful inquiries at Manchester from large exporters, and I am assured that the *declared* value must approach within $2\frac{1}{2}$ to 5 per cent. of the *actual* value, and that the former is quite as likely to be below the latter as above it. The advice to the shipping agent, who makes the declaration for entry at the Custom-house, is sent off after the merchant has made all the entries in his own books. It is therefore the most natural and convenient practice to give the actual invoice amount of the goods in round sums, that is, omitting shillings and pence, and perhaps fractions of £5. For example, if a bale came to £82. 10s., the exporter might call it either £80 or £85: if it came to £89, some might enter it as £85, others as £90. That the exporter should make a false declaration, without any thing to gain by it, is not to be conceived. One of my informants states, that if there is any material inaccuracy, it is at the ports of Hull and Goole, from which goods are exported by the German houses to Germany; as those houses do not regularly send the value to their shipping agents, but generally content themselves with mentioning the marks and contents of the bales. We might therefore suspect inaccuracy in the "declared value" at these ports, though there would be no reason to suppose that the declarations erred on one side more than on the other. But I have endeavoured to test this point, and the result is such as to prove that, notwithstanding the loose way in which the declarations are made, there is not any serious inaccuracy in the "real or declared value" of the exports at Hull and Goole. The method I pursued was as follows:—I took out the number of yards of white and printed cottons exported to Germany and the United Netherlands in each year, from 1827 to 1832 inclusive,

and ascertained what would be their price per yard according to the "declared value;" and then did the same with the white and printed cottons exported to the United States, China, the East Indies, and Brazil. The results were as follow:—

Years.	Quantity of White and Printed Cottons exported to *Germany* and the *Netherlands*.	Declared Value of the same.	Price per Yard, according to the declared value.	Years.	Quantity of White and Printed Cottons exported to the *United States, China,* the *East Indies*, and *Brazil.*	Declared Value of the same.	Price per Yard, according to the declared value.
	Yards.	£.	*Pence.*		*Yards.*	£.	*Pence.*
1827	57,410,133	2,090,413	8¾	1827	126,241,083	4,732,432	9
1828	52,779,261	1,832,346	8¼	1828	136,865,275	4,974,790	8¾
1829	52,419,444	1,581,237	7¼	1829	122,363,499	4,851,202	9⅓
1830	54,350,773	1,596,983	7	1830	117,735,846	4,974,429	8
1831	54,806,140	1,313,566	5¾	1831	138,245,272	4,382,860	7½
1832	71,496,009	1,661,886	5½	1832	145,920,479	3,641,209	6

Both these tables indicate a gradual decline in the value of the goods from 1827 to 1832, and, as might be expected, the decline is steadier in the first than in the second table, owing to the greater uniformity in the qualities and prices of goods sent to the European markets than of those sent to the distant markets of America and the East. But the decline in price, as indicated by the "declared value," corresponds very nearly with the actual decline in the price of calico in the Manchester market during the same six years, as will be seen from the following table, furnished to the Factory Commission by Mr. John Howard, of Manchester:—*

* Supplementary Report, part I. p. 186.

AVERAGE PRICE OF A PIECE OF CALICO $\frac{7}{8}$ 72, STOCKPORT COUNT, WEIGHING NOT LESS THAN 5 lbs. 2 oz.

Years.	s.	d.	Years.	s.	d.
1827	10	0	1830	8	9
1828	9	6	1831	9	0
1829	8	8	1832	8	3

The decline in the price of cotton twist corresponds still more nearly with the decline in the "declared value" of the exported goods, as is shewn by the following table of the prices of one kind of twist, furnished to the Factory Commission by Messrs. Samuel Greg and Co.*—

AVERAGE PRICE OF TWIST PER lb.

	d.
From Dec. 1825 to July, 1826	16·5
.. July, 1826 — Dec. 1826	15·17
.. Dec. 1826 — July, 1827	14·97
.. July, 1827 — Dec. 1827	14·77
.. Dec. 1827 — July, 1828	13·
.. July, 1828 — Dec. 1828	13·3
.. Dec. 1828 — July, 1829	12·96
.. July, 1829 — Dec. 1829	13·43
.. Dec. 1829 — July, 1830	13·28
.. July, 1830 — Dec. 1830	12·72
.. Dec. 1830 — July, 1831	12·82
.. July, 1831 — Dec. 1831	12·37
.. Dec. 1831 — July, 1832	12·76
.. July, 1832 — Dec. 1832	12·61

If the prices of the goods exported to Germany and the Netherlands, as indicated by the "declared value,"

* Supplementary Report, part I. p. 186.

are compared either with the prices of the goods exported to America and the East, or with the actual prices of calico and twist in Manchester, there will be found so great a correspondence between them as clearly to prove that the former approximate closely to the truth. We may, then, rely on the "real or declared value" of the cotton exports, and reason from it: and, if so, Mr. M'Culloch's estimate (£34,000,000) cannot materially exceed the actual value of the cotton goods annually produced in the United Kingdom; for the average of the "declared value" of the exports for 1830, 1831, and 1832, was £18,028,087, and it is admitted that the domestic consumption is to nearly as great a value as the foreign export.

Mr. Burn, in his "Commercial Glance," gives a detailed estimate of the value of cotton exports, including however England only. This would lead to a conclusion as to the total value of the manufacture, considerably differing from that which has been given above. Mr. Burn's table is as follows:—

Statement shewing the WEIGHT of YARN in MANUFACTURED COTTON GOODS EXPORTED from ENGLAND in the Year 1833; also the value per Piece, per Yard, &c. and Yarn per lb. when so manufactured; together with the Total Amount of each description.

DESCRIPTION.	No. of yards, &c. of each description.	Length of each Piece.	No. of Pieces, &c. of each description.	Weight of yarn in each Piece.	Total weight of yarn exported in goods.	Average price of each Piece, &c.	Average price per yard, &c. of each description.	Value of yarn when manufactured into goods, per lb.	Total amount of goods exported in 1833. £ only put down.
	Yards.	Yards.		lbs. oz.	lbs.	s. d.	s. d.	s. d.	£.
Dimities	150,599	60	2,510	12 0	30,120	26 3	5¼	2 2¼	3,294
Quiltings and Ribs .	256,127	60	4,269	18 0	76,842	52 6	10½	3 9	11,206
Lawns and Lenos .	7,843	20	392	2 8	980	10 10	6½	4 4	212
Calicoes, Printed .	143.573,899	28	5,127,639	4 0	20,510,556	11 11½	5⅛	2 11¾	3,065,901
Calicoes, Plain . .	172.082,093	24	7,170,087	5 12	41,227,999	7 4	3½	1 3½	2,629,031
Cambrics and Muslins	12,754,366	20	637,718	3 0	1,913,151	10 5	6¼	3 5½	332,145
Cotton & Linen, Mixed	2,840,687	40	71.017	8 0	568,136	11 4	3¼	1 5	40,244
Ginghams	2,079,896	20	103,995	3 0	311,985	10 5	6¼	3 5½	54,164
Imitation Shawls .	329,836	12	27,486	2 8	68,715	6 3	6¼	2 6	8.589
Nankeens	17,935,523	50	358,710	8 0	2,869,680	17 8½	4¼	2 2½	317,608
Velveteens, &c. .	8,162,991	60	136,019	20 0	2,720,980	52 6	10½	2 7½	357,128
Lace, &c.	79,193,574	40	1,979,839	8	989,919	10 10	3¼	21 8	1,072,412
Ticks, &c.	431,672	50	8,634	20 0	172,680	25 5	6¼	1 3¼	10,972
Damasks	32,701	36	908	10 0	9,080	24 9	8¼	2 5¾	1,123
Counterpanes . .	54,886	No.	54,886	7 0	382,202	6 0	6 0	10¼	16,466
Shawls, &c. . . .	690,514	Doz.	690,514	2 8	1 726,285	6 3	6¼	2 6	215,785
Tapes, &c. . . .	116,431	Doz.	116,431	1 0	116,431	1 9	2	1 9	10,188
Hosiery	468,602	Doz.	468,602	2 8	1,171,505	11 0	10½	4 5	257,931
Unenumerated . .	137,709	£	sterling.	10 0	1,377,090			2 0	68,854
Total weight of Cotton Yarn exported in manufactured goods in 1833					76,246,339	at 2s. 3½d. per lb.			8,473,293
. . . . Yarn exported					67,760,822	at 1s. 3d.			4,235,051
. . . . Thread					1,187,601	at 2s. 0½d.			121,234
				lbs.	145,194,762			£	12,829,548

Thus Mr. Burn makes the cotton exports of England to be of the value only of £12,829,548. The "real or declared value" of the cotton exports of Great Britain, in the books of the Custom-house, for 1833, was £18,459,000. The exports from England and Scotland are not given separately in any official returns; and I am therefore unable to compare the value of the English exports as "declared" by the exporters at the Custom-house, with that stated by Mr. Burn. But the cotton goods exported directly from Scotland are of trivial amount, as nineteen-twentieths of the goods manufactured for the foreign market in Scotland are exported, not from Scotch ports, but from Liverpool. Considering the English exports, therefore, as comprising nearly the whole cotton exports of Great Britain, it follows that Mr. Burn's estimate falls short of the "real or declared value" by no less than *five millions and a half.* With every disposition to rely on the practical knowledge of this author, I must place still greater dependence on the official record, for the reasons above given; and I am therefore driven to the conclusion, that Mr. Burn must be mistaken in some of the data on which he has built his calculations.

All estimates founded on an assumed average value of the goods must be liable to considerable errors, owing to the many descriptions and diversified qualities of goods, which render it difficult to strike the average correctly: and a very slight inaccuracy in the sums which form the elements of the calculation will produce an important error in the results.

Mr. Kennedy, whose assistance I have frequently had to acknowledge, was last year so obliging as to make for me an estimate, along with other well-informed

merchants and manufacturers, of the annual value of the cottons produced in the United Kingdom. The following is the result of their calculations; it is founded on Mr. Burn's estimate for 1832, contained in his "Glance," and therefore supports that estimate, but, at the same time, is necessarily liable to any errors into which Mr. Burn may have fallen:—

Estimate of the Value of the Cotton Goods and Yarn produced in Great Britain and Ireland, in the Year 1832.

	How disposed of.	Descriptions of Goods.	Quantity in lbs. weight.	Value.
ENGLAND.	Exported	Yarn	72,000,000	£4,500,000
		Thread	1,000,000	500,000
		Goods	62,000,000	6,747,000
		Yarn to Scotland and Ireland	5,000,000	375,000
		Mixed Manufactures	12,000,000	600,000
	Home Consumption		71,000,000	9,000,000
			lbs. 223,000,000	£21,722,000
SCOTLAND.—Value supposed 1-8th of the English				2,700,000
IRELAND. —Value supposed 1-8th of the Scotch				338,000
				*£24,760,000

* The above table of Mr. Kennedy's was given in my sketch of the History of the Cotton Manufacture, published in my father's "History of the County Palatine of Lancaster" last year, where it attracted the attention of Mr. M'Culloch, who, in the second edition of his "Dictionary of Commerce" has made the following forcible remarks upon it:—"Mr. Kennedy, to whose opinion, on a matter of this sort, the greatest deference is due, considers this estimate (£34,000,000) as a great deal too high. We cannot, however, bring ourselves to believe that such is really the case. It appears from the official accounts, that the real or declared value of the cotton fabrics exported in 1832 amounted to £12,622,880, and that of the twist to £4,726,796. Now it appears from the statement in *Burn's Glance*, (for 1832) and other good authorities, that the weight of the cotton yarn retained at home to be wrought up into fabrics for domestic use is about 10 or 12 per cent.

On this estimate I must make the same observation as on Mr. Burn's, namely, that it cannot be reconciled with the official record of the "declared value" of the exports, which in 1832 was £17,398,392. If the latter approaches to correctness, Mr. Kennedy's estimate must be several millions below the real value of the manufacture. A presumption that it is so, is afforded by the Scotch and Irish manufactures, each of which is here valued at only about one-half the estimates made by other good authorities. Dr. Cleland, of Glasgow, whose reputation as a statistician is high, and who had (as he assures me) the aid of the most eminent merchants and manufacturers of that city, calculated in 1818 that "there were 105,000,000 yards of cotton cloth manufactured in Glasgow and its neighbourhood, the value of which could not be less than £5,200,000, and that nearly one-half of these goods were exported."† Since 1818, the quantity of cottons manufactured in Scotland has doubled, but the nominal value is probably not higher than at that time: this is, however, nearly twice as much as Mr. Kennedy's estimate of the Scotch manufacture. The value of the Irish cotton manufac-

greater than the weight of the yarn exported in the shape of manufactured goods. But without taking this greater weight into account, if we suppose that the fabrics retained at home are nearly equal in point of quality to those exported, the value of the manufacture must be at least £30,000,000, viz. fabrics exported £12,622,000, twist exported £4,721,000, and fabrics consumed at home £12,622,000. But a very large proportion of our exports consist of comparatively coarse fabrics destined for the West Indies, Brazil, &c.; and we have been assured, by those well acquainted with the trade, that the value of the fabrics made use of at home cannot be less, at an average, than from 30 to 40 per cent. above the value of those exported; but taking it only at 30 per cent. it will make the total value of the manufacture £34,000,000. We do not well see how this statement can be shaken. The exporters have no motive to exaggerate the real value of the goods and yarn sent abroad; but unless they have done so to a very great extent, it will be difficult to impeach the above conclusion."—*Dictionary*, p. 443. 2d edit.

† Dr. Cleland's Statistics of Glasgow, p. 138

ture, which that gentleman takes at £338,000, is estimated by Mr. Bannatyne at £700,000.* It is scarcely necessary to remark, that the estimates of Dr. Cleland and Mr. Bannatyne, of the value of the Scotch and Irish manufactures, indirectly support the estimate I have formed of the English manufacture, from the proportions which are well known to exist between the three.

I now offer a mode of calculating the value of the manufacture, different from any hitherto adopted, and which would be very satisfactory if we possessed all the particulars requisite to carry it out. Mr. M'Culloch takes an assumed value of the whole manufacture, and divides it, into its constituent parts, of wages, profit, cost of raw material, &c. I propose—reversing the operation—to ascertain as many of the constituent parts as possible, and, by adding them together, to find the whole value. We have ascertained, with considerable precision, the number of factory operatives employed in the cotton trade, and the returns made to Mr. Cowell and Mr. Stanway establish the rate of wages they receive. There is pretty satisfactory evidence as to the number of hand-loom weavers, and their wages; as to the number of calico printers, lace workers, and stocking makers, with their wages respectively. The value of the raw material is known. And an estimate may be made of the profits of capital, wear and tear of machinery, and other expenses. There are still many classes of workmen, the combined amount of whose wages can merely be guessed, and the sum I have put down under this head is offered only as a conjecture. I proceed to mention the particulars:—

* Encycl. Britannica, art. "Cotton Manufacture."

Estimated Yearly Value of the British Cotton Manufacture.

	WAGES OF	£.
237,000	*Operatives engaged in spinning and power-loom weaving	6,044,000
250,000	†Hand-loom weavers, at 7s. per week each	4,375,000
45,000	‡Calico printers, at 10s. per week each .	1,170,000
159,300	§Lace-workers (including 100,000 employed in embroidering, and 30,000 in mending, pearling, drawing, and finishing) .	1,000,000
33,000	‖Makers of cotton hosiery	505,000
——	Bleachers, dyers, calenderers, fustian-cutters, machine makers, makers of steam-engines, cards, rollers, spindles, shuttles, looms, and reeds; smiths, joiners, builders (of all classes), millwrights, carriers, carters, warehousemen, &c. &c. &c. *say*	4,000,000
Raw material (spun in 1833,) 282,675,200 lbs.¶ at 7d. per lb.		8,244,693
Profits of capital, sums paid for materials of machinery, coals, flour for dressing, and other outgoings**		6,000,000
	Total . .	£31,338,693

* Mr. Stanway, from the returns of the mill-owners, ascertained that 67,819 mill operatives in England received £141,635. 5s. 7¾d. as wages for a month of four weeks: at the same rate, 237,000 mill operatives, the number in the United Kingdom, would earn £6,434,453 per year. But as wages in Scotland are 10 per cent. and in Ireland 15 or 20 per cent. lower than in England, and as two weeks' wages in the year ought to be deducted for holidays, the amount of wages paid will be about £6,041,000.

† See p. 238. In my estimate of the *number* of weavers, I have not reckoned the winders, draw-boys, &c. who assist them, and who must amount to a great many thousands; but, in the supposed average of their *wages*, I include those earned by the assistants of the weavers as well as by the weavers themselves. For particulars concerning the weavers' wages, see the next chapter. The sum of 7s. per week, for the *gross* wages of all the hand-loom weavers, is, I am convinced, a fair estimate. The calculation is for 50 weeks in the year.

‡ See pp. 284 and 396.

§ See p. 343. The wages paid to the women and children employed in embroidering, mending, &c. the lace must be extremely low. Mr. Felkin estimates the whole value of the lace manufactured in England at £1,850,650; deduct the cost of the yarn, £635,000, and there remains the sum of £1,215,650; of which, probably £1,000,000 consists of wages to the work-people.

‖ See p. 315.

¶ The quantity stated by Burn in the "Commercial Glance."

** I adopt this sum from Mr. M'Culloch, thinking it a moderate estimate.

The only item in the above estimate which I feel to be subject to considerable doubt is the sum of £4,000,000 as the wages of the bleachers, dyers, machine makers, and numerous other classes of workmen not otherwise specified. It does not appear unreasonable, but I distinctly acknowledge it to be only conjectural. The total sum arrived at by this calculation seems to be strongly supported by the "real or declared value" of the cotton exports.

On the whole, after an attentive consideration of all the official and unofficial evidence which has been presented, I am of opinion that the annual produce of the cotton manufacture of the United Kingdom must be between £30,000,000 and £34,000,000; and that the number of individuals directly employed in the manufacture, with those dependent on them for subsistence, must amount to *fifteen hundred thousand.*

The estimates of the amount of capital invested in the cotton manufacture are attended with still greater uncertainty than estimates of the yearly produce. Mr. Kennedy, however, who is perhaps the best authority on this subject, is of opinion, after careful calculation, that the fixed capital employed in the spinning of cotton alone, that is, in all the spinning machinery, mills, and other apparatus, amounts to £7,000,000; and that the fixed capital engaged in the processes of throwing or doubling, twisting, winding, warping, dressing, weaving, bleaching, dyeing, printing, and in hosiery and lace frames, may amount to £8,000,000; and that the floating capital requisite to keep all the machinery in motion, and to carry on the spinning and other branches of manufacture, may be £15,000,000. This

would make a total of £30,000,000; and may be thus shewn:—

	£.
Fixed capital invested in the spinning business, (including mills, machines, &c.)	7,000,000
Fixed capital invested in the preparation of the yarn, weaving, bleaching, dyeing, printing, and in hosiery and lace frames	8,000,000
Floating capital employed in all the above branches	15,000,000
	30,000,000

In the first of these items, as in other instances, it seems to me that Mr. Kennedy errs on the side of moderation. Mr. Burn states (p. 368 *ante*) that 17s. 6d. per spindle is the present valuation for mills and machinery in the cotton spinning business; at which rate, as there are about 9,333,000 spindles in the United Kingdom, the whole of the mills and machinery would be worth £8,166,375. 'A highly respectable and intelligent cotton spinner, to whom I have submitted the question, says, after ascertaining the cost of the machinery in his own extensive works'—"At a moderate estimate, and certainly considerably below the actual cost, I find that the machinery employed in spinning cotton amounts to £60 for each individual employed, including water-wheels, steam-engines, shafts and gearing, straps, drums, &c. &c., but *exclusive* of the money sunk in buildings, land, weirs, embankments, &c." Now, we have estimated the mill operatives at 237,000, of whom about 57,000 are engaged in power-loom weaving; the remainder, 180,000, are engaged in cotton spinning and doubling, and this number, at £60 each, (which excludes the buildings, land, &c.) would shew

the value of the spinning machinery alone to be £10,800,000. That this is not too high an estimate, seems probable from the statement of Mr. Holland Hoole, who says (in his "Letter to Lord Althorp, in Defence of Cotton Factories," p. 8,)—"A cotton factory, upon the fire-proof principle, adapted for the employment of 1000 persons, cannot be built, filled with machinery, and furnished with steam-engines and gas-works, for a less sum than £100,000." This calculation, therefore, is £100 for each individual employed: if it were correct, the value of the spinning mills and machinery would be £17,200,000. Amidst these widely different estimates, we shall scarcely err on the side of excess, if we take the valuation given by one of my informants to the machinery alone, namely, £10,800,000, as the value of the mills and machinery together. The capital invested in factories and machinery for power-loom weaving is estimated, by the practical gentleman already mentioned, to amount to £24 for each individual employed; and, as at least 57,000 individuals are employed in that department, the whole capital must amount to £1,368,000. Add this to the capital invested in the spinning mills, and it will make a total sum of £12,168,000. On the whole, Mr. M'Culloch's estimate of the amount of capital directly employed in the manufacture, namely, £34,000,000, appears to me very moderate.

The foreign countries to which our cotton manufactures are exported, will be seen from the following official return, taken from the "Tables of Revenue, Population, Commerce, &c. for 1833," page 167. The return is for 1832, being the latest that has been made up in this detailed manner:—

EXPORTS OF COTTON MANUFACTURES, 1832.

An Account of the Quantity and Declared Value of British Cotton Manufactured Goods Exported from the United Kingdom, distinguishing the Description of Goods, and the various Countries whereto the same were Exported, in the year 1832.

Countries to which Exported.	White or Plain Cottons.		Printed or Dyed Cottons.		Hosiery and Small Wares.	Twist and Yarn.		Total Declared Value.
	Yards.	Declared Value.	Yards.	Declared Value.	Declared Value.	Pounds.	Declared Value.	
		£.		£.	£.		£.	£.
Russia	2,751,714	100,014	272,655	10,143	12,720	19,587,781	1,136,787	1,259,964
Sweden	24,597	938	10,568	368	421	743,747	38,355	40,082
Norway	48,260	1,254	98,293	2,670	1,117	13,035	610	5,651
Denmark	237,051	4,561	38,604	1,140	361	71,680	2,320	8,382
Prussia	108	8	225	16	33	26,241	2,001	2,038
Germany	16,527,644	341,732	34,951,334	821,143	330,500	29,959,427	1,796,967	3,226,362
Holland	11,510,587	265,883	6,505,944	233,128	51,320	10,321,574	88[illegible],935	1,457,266
Belgium	1,293,757	49,671	1,122,706	48,275	198,766	24,075	3,488	300,200
France	300,059	12,444	520,428	16,683	35,869	8,457	1,314	66,310
Portugal, Proper	8,738,277	152,786	4,603,411	133,600	10,906	37,230	2,899	300,191
Azores	532,448	9,920	496,413	10,112	712	28,600	1,223	21,972
Madeira	205,036	4,309	149,530	3,046	532	54	5	8,542
Spain and the Balearic Islands	1,340,395	32,969	1,600,574	39,107	2,877	10,430	771	75,724
Canaries	193,310	4,873	184,619	4,024	339	1,200	56	9,892
Gibraltar	6,441,556	128,388	5,446,777	152,636	13,240	95,922	7,041	301,305
Italy and the Italian Islands	34,650,087	761,968	13,041,277	353,871	41,874	7,641,928	381,948	1,539,661
Malta	868,256	21,232	459,814	13,852	970	205,450	10,382	46,436
Ionian Islands	567,214	9,332	217,793	6,929	682	55,605	3,048	19,991
Turkey	15,718,349	370,173	8,488,020	262,221	1,046	1,301,913	60,440	702,880
Morea and Greek Islands	9,150	244	107,598	4,387	....	1,200	50	4,681
Egypt (Ports on the Mediterranean)	2,154,908	41,242	404,932	14,703	16	199,280	19,319	75,335
Tripoli, Barbary and Morocco	7,050	205	....	....	2	....	....	207
Western Coast of Africa	996,170	23,746	2,881,864	73,895	365	1,070	169	98,175
Cape of Good Hope	1,831,230	45,371	1,633,356	48,339	6,064	1,355	126	99,900
St. Helena	36,460	964	16,908	470	118	169	12	1,564
Mauritius	1,568,322	43,962	797,233	25,011	3,925	2,500	126	73,024
China, East India Company's Territories, and Ceylon	35,917,820	853,043	15,916,093	458,730	18,097	4,316,045	302,379	1,632,849
Ports of Siam, Sumatra, Java, and other Indian Islands	1,379,314	54,387	792,384	30,659	503	102,500	6,920	92,409
Philippine Islands	1,251,595	38,671	151,582	33,995	....	....	......	72,666
New South Wales, Van Diemen's Land, and Swan River	739,192	21,007	1,065,714	37,829	7,905	9,411	509	67,250
New Zealand and South Sea Islands	1,400	50	1,800	50	45	....	......	145
British North American Colonies	8,067,414	191,731	8,099,461	219,499	30,606	260,699	8,632	450,468
British West Indies	11,037,119	244,117	11,594,821	384,803	30,040	4,973	485	659,445
Hayti	4,961,460	135,906	6,601,624	185,318	13,768	252	20	335,012
Cuba, and other Foreign West Indies	7,358,886	159,007	8,443,923	214,742	10,590	500	50	384,389
United States of America	13,335,382	365,732	18,173,302	683,643	193,109	82,104	5,045	1,247,529
Mexico	1,632,193	42,491	1,792,308	58,572	5,607	467,323	29,537	136,207
Guatemala and Columbia	4,807,854	109,801	2,980,130	73,945	5,676	100	8	189,430
Brazil	36,849,740	683,731	23,728,082	596,330	33,028	11,460	1,676	1,314,765
States of the Rio de la Plata	11,182,469	217,801	6,074,369	173,790	33,344	....	.....	424,935
Chili	9,310,080	217,[illegible]	4,551,354	151,310	32,047	1,700	20	401,127
Peru	1,937,433	60,527	1,531,301	53,197	16,918	640	80	130,722
Isles of Guernsey, Jersey, Alderney, Man &c.	406,788	31,033	292,923	8,020	22,245	8,880	1,841	63,139
Total	250,193,096	5,851,924	201,552,407	5,645,706	1,175,003	75,667,150	4,722,759	17,398,392

The topography of the cotton manufacture and of its principal branches requires some observations. Five great districts may be specified as seats of the cotton manufacture:—1st. Manchester, with from thirty to fifty miles in every direction round it. 2d. Glasgow, the same, but extending to Perth, Aberdeen, and through many parts of the Highlands. 3d. Nottingham, taking in Derby, Warwick, Lichfield, &c. 4th. Carlisle, branching out in every direction, so as to meet the Manchester and Glasgow divisions. 5th. The Irish counties of Antrim, Armagh, Dublin, Kildare, and others to a small extent.

Of these, the Lancashire district is much more important, for the quantity, variety, and excellence of its productions, than all the others together. In that county, the original seat of the British cotton manufacture, the departments of spinning, manufacturing, bleaching, and printing, are all carried to the highest perfection. The Manchester mills supply the finest yarns for the manufacture of muslins at Glasgow, and of lace at Nottingham; and almost every description of cotton goods, except lace and hosiery, is made in Lancashire.

The following table, for which I am indebted to a Manchester manufacturer and dealer, shews the principal descriptions of goods manufactured in Lancashire, with a topographical arrangement of the great branches of the trade:—

Descriptions of Cotton Goods made in Lancashire with the places where manufactured.

Descriptions of Articles.	Whether made by Hand-looms or Power-looms.	Places where manufactured.
Stout Printing Calicoes	Power.	Hyde, Ashton, Duckenfield, Stockport, Stayley-bridge, Manchester
Stout Calicoes for domestic purposes, viz. sheeting, coarse shirting, &c.	Chiefly Power.	Todmorden, and various other places.
Common Printing Calicoes	Hand.	Blackburn, Burnley, Colne.
Superfine Printing Calicoes and Muslins	Hand.	Bolton, Chorley, Preston.
Furniture Dimities, Garment and Pocket, do.	Hand.	Edenfield, Bury, Hebden-bridge, Bolton.
Cotton Velvets, Velveteens, Beaverteens, Swandowns, Pillows, Moleskins, &c.	Power & Hand	Oldham, Warrington, Manchester Lymm, Bury, Heywood.
Striped Cottons, Ticks, Checks, &c.	Chiefly Hand.	Manchester, Stockport, Eccles.
Ginghams	Hand.	Manchester, Ashton, Preston, Chorley.
Gingham Handkerchiefs pocket and neck, Romols and Pullicats	Hand.	Manchester, Failsworth, &c.
Cambric Muslins	Hand.	Bolton.
Jaconet Muslins	Hand.	Blackburn, Chorley, Preston, Manchester.
Cotton Shirtings	Chiefly Power*	Stockport, Manchester, Preston, and various other places.
Counterpanes and Bed Quilts	Hand.	Bolton.
India Dimities, Satteens, Jeans	Chiefly Hand.	Bury, Bolton, Manchester.
Quiltings for Waistcoats	Hand.	Manchester, Bolton, Bury.
Quiltings for Toilet Covers	Hand.	Manchester.
Coloured Cotton Table Covers, damask and figured	Hand.	Manchester.
Nankeens	Hand.	Prestwich, Eccles, Stand, Radcliffe
Small Wares	Chiefly Power.	Manchester.
Fancy Muslins	Hand.	Bolton, Chorley, Manchester.
Hat Linings, Umbrella cloths, &c.	Hand.	Manchester, Failsworth.
Cotton Shawls	Hand.	Bolton.
Coarse Chambrays	Hand.	Manchester, Eccles.
Fabrics of Linen and Cotton for Trowsers	Hand.	Manchester.
Fabrics of Cotton & Worsted for do.	Hand.	Newton and Failsworth.

* The hand-looms in this branch are gradually disappearing

The following account of the places where several of the branches of manufacture are carried on is from Mr. Bannatyne's article in the Encyclopædia Britannica:—"The manufacture of dimities has been exclusively confined to the north of England: the finer qualities are made at Warrington, and the coarser in the western part of Yorkshire. Balasore handkerchiefs were first manufactured about Preston and Chorley, where they still continue to be made. The manufacture of ginghams was for a long time confined to Lancashire, but for many years it has been extensively introduced at Glasgow, although Lancashire continues to be the chief seat of this branch. Pullicat handkerchiefs were first made about the year 1785 at Glasgow; where the manufacture of them has been carried to a great extent. They were not made in Lancashire till some time afterwards, and the manufacture of them there has never been to the same amount. Blue and white checks and stripes for exportation were at first of a linen fabric, but were afterwards woven with linen warp and cotton weft. A great proportion of these goods are now made wholly of cotton. This manufacture is carried on in Lancashire, and in the county of Fife, and to a small extent at Aberdeen; its chief seat, however, is Carlisle. The manufacture of cotton cambric was separated into two branches; into cambric to be used as garments in a white or printed state; and into cambric made in imitation of French linen cambric, to be used for the same purposes as that article. The first is made nearly altogether in Lancashire, where the manufacture of it is carried on to a great extent; and the second, of much less amount, wholly at Glasgow. Bandana handkerchiefs, and Bandana cloths for garments, were first

made by Mr. Henry Monteith, at Glasgow, about the year 1802, and are now manufactured there to a considerable amount."

The calico printing is carried on chiefly in the immediate neighbourhood of Manchester, in the valleys lying betwixt Blackburn, Clitheroe, and Bury, and in the neighbourhoods of Glasgow, Dublin, and London. The principal bleachers have their works in the vicinity of Bolton, Blackburn, Manchester, and Glasgow.

The Population Returns of 1831, though they furnish but little of that exact and definite information which might have been expected in illustration of the numbers employed in the cotton manufacture, present nevertheless certain important facts which may assist us in forming our conclusions. They shew the total population of the counties, towns, &c. in which the manufacture exists; the number of families engaged in manufactures, trade, and handicraft; the number of adult males employed in manufacture or in making manufacturing machinery, &c.; and they also give at the end of each county some brief and general account of the manufactures carried on therein, and, in notes to the parishes, occasional intimations of the great increase of manufactures, as accounting for the rapid increase of population. I shall select from the Returns such particulars as throw any light on our inquiry, but confining the selections to those counties in which the cotton is the great and predominating manufacture. These counties are Lancashire, Cheshire, Nottinghamshire, Derbyshire, Cumberland, Lanarkshire, and Renfrewshire.—

POPULATION of the Counties of England and Scotland which are the principal seats of the COTTON MANUFACTURE; with the Occupations of the Inhabitants; from the Abstract of the Population Returns of Great Britain in 1831. Also the Population of the same Counties in 1750.

Counties.	Population	Occupations. Families chiefly employed in agriculture.	Families chiefly employed in trade, manufactures and handicraft.	All other families not comprised in the two preceding classes.	Males twenty years of age.	Occupations of Males 20 Years of Age. Occupiers and labourers in agriculture.	Employed in manufacture, or in making manufacturing machinery	Employed in retail trade, or in handicraft, as masters or workmen.	Capitalists, bankers, professional & other educated men.	Labourers employed in labour not agricultural.	Other males 20 years of age, including servants.	Population in the year 1750
ENGLAND.												
Cheshire . . .	334,391	16,397	34,997	13,561	78,940	23,527	13,305	22,134	2,626	2,723	4,625	131,600
Cumberland .	169,681	10,630	12,026	12,164	40,614	15,466	3,214	11,186	1,802	6,077	2,869	86,900
Derbyshire . .	237,170	13,324	20,788	14,208	58,178	18,170	8,563	14,787	1,829	10,897	3,632	109,500
Lancashire . .	1,336,854	24,696	173,693	61,636	313,097	37,321	97,517	86,079	17,614	60,546	11,020	297,400
Nottinghamshire	225,327	13,351	25,578	8,188	56,552	16,856	14,260	14,683	2,093	5,628	3,062	77,600
SCOTLAND.												(In 1755.)
Lanarkshire .	316,819	4,504	39,692	20,680	73,670	6,645	26,677	24,046	3,569	6,303	6,430	62,205
Renfrewshire .	133,443	2,016	21,071	5,117	28,099	3,317	9,617	8,295	1,259	4,054	1,557	26,645
	2,753,685	84,918	327,845	135,554	649,180	121,302	173,453	181,210	30,792	106,225	33,195	791,850

I add the observations attached to the Population Returns for the different counties, so far as they relate to the cotton manufacture:—

LANCASHIRE. "The manufactures of Lancashire produce such a variety of articles as cannot be described, or even distinctly enumerated; the predominating manufacture is that of cotton, producing cotton cloth, muslin, calico, cambric, ginghams, fustians, swandowns, fancy quiltings, other fancy work, and small wares. These are produced by manufacturers exhibiting a division of labour not easily defined; carders of the raw material, cotton yarn spinners by machinery, bleachers, warpers, cutters and drawers, rovers, power-loom and hand weavers, dressers, dyers, designers and drawers of patterns, engravers, block-cutters, block-printers, crofters, finishers, sizers. Many of these operations are in common with the silk manufacture, which has been largely introduced into Lancashire, and is too much mingled with the cotton manufacture to be here distinguished.* The males upwards of twenty years of age employed in these manufactures are but in small proportion to the boys and females; *yet the number of men is not much less than* 97,000; of these in the hundred of *Amounderness* are mentioned 3000 at Preston, 230 at Kirkham, and about 1000 collectively at Goosnargh, Wood Plumpton, and forty other places. In the hundred of *Blackburn*, 8700 men are employed in the very extensive parish of Whalley; 3350 in the township of Blackburn, and 3500 in the other townships of that large parish; the township of Ribchester (in the parish of Ribchester) contains 256; besides these, nearly 2000 in several other places in Blackburn hundred. In the hundred of *Leyland*, Chorley contains 1200 males employed

* The silk manufacture in Lancashire, though rapidly growing, is quite insignificant in comparison with the cotton manufacture. In 1832 there were in Manchester, Salford, and Newton, only sixteen silk mills, (*Tables of Revenue, &c.* part ii. p. 102.) and I believe there are very few others in the county; and the whole number of looms engaged in the silk manufacture in Lancashire was 14,000, of which from 8 to 9000 were employed in weaving silk alone, and from 5 to 6000 in weaving mixed goods. (See Report of the Commons' Committee on the Silk Trade in 1832.) A very small deduction must, therefore, be made from the manufacturing classes in Lancashire on this account; though the remark in the Population Returns might lead to the supposition that the silk manufacture was comparable in extent with the cotton.—*Author.*

in the cotton manufacture, the township of Leyland 400, and the residue of that parish in various townships collectively 2300; in other places 450. In the hundred of *Lonsdale north of the Sands*, about 100 males at Colton, and 40 at other places; in *Lonsdale south of the Sands*, about 140, chiefly at Caton, Scotforth, and Hulton. In the hundred of *Salford*, the town of Manchester contains about 12,000 men employed in the cotton and silk manufacture; Salford 3500, including many makers of machinery; Oldham 4000; and Crompton, in that parish, 4200; Great Bolton and Little Bolton 6100; Bury 1600; and Tottington 1500; Spotland and Castleton (in Rochdale parish) 2000; Middleton township 1100; Chorlton Row, near Manchester, 1900; Heaton Norris 1100; and other townships in the great parish of Manchester, about 4000 collectively; Pendleton 850; and, besides all these, are 18,000 in the numerous manufacturing townships of this populous hundred of Salford. In the hundred of *West Derby*, the town of Wigan contains 2600; the parish of Leigh 2800; and other places about 3000. The makers and repairers of spinning jennies, looms, and other machinery employed in the cotton, silk, and woollen manufactures, are very numerous, but are mostly connected with the cotton factories in such a manner as to preclude any distinct mention.

"It would be improper to close this attempt at enumerating the manufactures, and estimating the number of persons therein employed, without offering two observations: 1st. That *the column of the abstract which assigns* 60,516 *males to "labour not agricultural" does not include less than* 50,000 *of these*, in the hundreds of Salford and West Derby, in Manchester and at Liverpool, *who assist in various capacities in manufacture, and commerce dependant on manufacture.* 2d. That the column of "retail trade and handicraft" includes 86,079 men, of whom *a large portion*, (as may be seen in the above specification,) *would be attributed to manufacture* in other counties,* where not placed in comparison with the more extensive manufactures of Lancashire."—Vol. i. p. 308.

Cheshire. "The hundred of Macclesfield appears to be the principal manufacturing district in Cheshire: upwards of 6000

* How well justified this remark is, will appear from the following enumeration of trades included under the head "retail trade and handicraft," all of which

males (adults) are employed in manufacturing cotton and calico; nearly 1000 in silk; and about 5500 in cotton and silk promiscuously."—Vol. i. p. 68.

CUMBERLAND. "In the county of Cumberland the manufacture of cotton (including the makers of the machinery and the weavers by machinery) employs about 2200 males upwards of twenty years of age; calico and ginghams 300," &c.—Vol. i. p. 98.

DERBYSHIRE. "Various kinds of manufacture exist in the county of Derby; in which males upwards of twenty years of age so employed may be classed as follows:—In the cotton-yarn and silk manufacture about 1700; framework and twist 1400; cotton and silk hosiery 1200; calicoes and ginghams 600; lace and twist

are more or less connected with the cotton manufacture, and some of them are entirely and absolutely dependent upon it:—

Bleacher	135	Iron-founder	816
Boat-builder, Shipwright	989	Lace-dealer	37
Boiler-maker	7	Millwright	64
Broker	330	Moulder	13
Brush-maker	220	Nailor	510
Builder	323	Pattern card-maker	2
Bricklayer	1785	Pattern-drawer, Designer	5
Brickmaker	684	Reed-maker	37
Lime-burner	75	Roller-maker	12
Plasterer	1326	Rope-maker	802
Slater	496	Shuttle-maker	14
Mason	3203	Sizer	43
Calenderer	81	Skinner	6
Card-maker	2	Small-ware dealer	14
Carpenter	6267	Spindle and Fly-maker	6
Wheelwright	1487	Starch-maker	4
Sawyer	1363	Tanner	290
Carrier, Carter	2367	Tinman	470
Colour-maker	4	Turner	722
Copperplate Printer, Engraver	504	Vitriol-maker	5
Currier	393	Wharfinger	41
Drysalter, Colouring materials	92	Whitesmith	1135
Dyer	1915	Wire-drawer	22
File-cutter	81	Wire-worker	31
Fustian-shearer	1		

Several of these trades, as the bleachers, calenderers, dyers, fustian-shearers, sizers, makers of boilers, cards, colours, pattern cards, reeds, rollers, shuttles, spindle and fly, &c., are employed directly and almost exclusively in connexion

net 450; tape 60; paper 40; and about 1,400 not accurately distinguishable, who are employed in making hosiery, lace, lace-frames, and frame-work machinery, tape, needles, the preparation of dye colours, &c."—Vol. i. p. 116.

NOTTINGHAMSHIRE. "The manufacture of stockings and lace is so considerable in the county of Nottingham, as to employ 13,600 males upwards of twenty years of age; of these, at Nottingham 4740; at Radford 1300; at Mansfield 800; at Sutton-in-Ashfield nearly 800; at Basford 750; at Snenton 430; at Hucknall-Torkard, at Beeston, at Linton, and at Carlton, upwards of 300 each; at Bulwell, Greasley, and Calverton, about 280 each; at Kirby-in-Ashfield, Mansfield-wood-house, Stapleford, Southwell, Lambley, Ruddington, and Selstone, between 200 and 100 each. In most of the places here named the manufacture of stockings, lace, frame-work, machinery, and the materials of the lace manufacture are so conjoined or intermingled as not to be distinguishable in a general description; 50 linen weavers are mentioned at Newark, and 19 at Howton; sacking is made at West Retford, candle-wicks at Gamston."—Vol. i. p. 488.

LANARKSHIRE. "The populous county of Lanark embraces every department of the cotton manufacture, from the imported raw material to the finished article. In Lanark (the county town) are 750 men, mostly employed in weaving; at Hamilton nearly as many; at New Monkland 680; at Lismahago 640; at Avondale 500; at Govan 450; at Rutherglen 400; at East Shilbride 300;

with the cotton manufacture. Other trades assist in making machinery for the same manufacture, as file-cutters, iron-founders, millwrights, moulders, nailors tinmen, turners, whitesmiths, wire-drawers, wire-workers, &c. Other trades are auxiliary to the calico-printing, as colour-makers, copperplate printers and engravers, drysalters, pattern-drawers, designers, vitriol-makers, &c. Others are to a considerable extent engaged in the building of cotton mills, warehouses, &c., as builders, bricklayers, brickmakers, plasterers, slaters, masons, carpenters, sawyers, &c. Others contribute to convey the raw material and manufactured goods, as shipwrights, wheelwrights, carriers, carters, wharfingers, &c. And others supply various articles connected with the manufacturing and mercantile department, as brush-makers, curriers, tanners, skinners, rope-makers, starch-makers, &c. It will be observed that some of the above trades have very incorrect numbers affixed to them: for example, there is reckoned only one fustian-shearer, whereas there are several hundreds in Manchester alone: the fustian-shearers have in all cases but this one been ranked (more properly) in the class of manufacturing operatives. The same remark applies to the "bleachers," &c.—*Author.*

at Dalserf 250; at Bothwell 240; and below that number down to 160; weavers are employed at Carluke, Old Monkland, Blantyre, and Cambusnethan. The entire number exceeds 7000; but of these several are employed in flax-dressing and weaving linen; hosiers also, lace-makers, and nailors, are mentioned in some of the returns; and there are iron-works of some extent at Shotts. But this summary of the manufacturing industry of Lanarkshire is of little importance as compared with the manufactures of the city of Glasgow, which (like many other ancient towns) is governed by a municipal jurisdiction distinct from that of the county at large; and this peculiarity has produced a considerable misfortune in the execution of the Population Act, as it is the only place in Great Britain from which the returns have not been obtained, further than an extract by Dr. Cleland, who supplied the enumeration as entered in the preceding pages, with the notes appended to it. Nothing more can be said of the manufactures of Glasgow than that 19,913 males, upwards of twenty years of age, are so employed; which number rather surpasses that enumerated in the central townships of the parish of Manchester."—Vol. ii. p. 1002.

Dr. Cleland's Notes. "There are 328 steam-engines in the city of Glasgow and suburbs; viz. in manufactories, 181; collieries, 62; stone-quarries, 7; steam-boats, 78; horse-power, 7,596 $\frac{9}{100}$ Average power of engines, 25 $\frac{61}{100}$.

"The first steam-engine for spinning cotton in Scotland was put up at Springfield, opposite the Steam-boat Quay, in January, 1792, by Messrs. Scott, Stevenson, and Co. In the city and suburbs there are 44 cotton mills, in which there are 1344 spinners, 591,288 mule spindles, 48,900 throstle spindles. These are exclusive of other extensive establishments belonging to Glasgow manufacturers in the country; viz. Messrs. James Finlay and Co. at Deanston, Ballandalloch, and Catrine; William Dunn, at Duntocher, Faifly, and Milton; David Laird and Co. at Stanley; and the Rothsay Spinning Company in Bute, &c. In 29 of the principal mills there are 6574 workers; viz. males, 2587, females, 3987, of the following ages, viz. from 9 to 10 years, 242; 10 to 12, 824; 12 to 14, 896; 14 to 16, 693; 16 to 18, 734; 18 to 24, 724; 21 and upwards, 2461.

"There are in the city and suburbs 63 steam-loom mills, which

contain 14,127 looms. Exclusive of these there are 32,013 hand-loom weavers; viz. in the city and vicinity, 18,537; in the country, working for Glasgow manufacturers, 13,476.

"Among the numerous extensive manufactories, the following are unequalled for ingenuity and extent. Messrs. Henry Monteith and Co. dyeing, discharging, and printing works, at Dalmarnock; Messrs. Charles Tennant and Co. chemical works, at St. Rollox, for the manufacture of sulphuric acid, chloride of lime, soda, and soap. This manufactory, the most distinguished and extensive of any of the kind in Europe, occupies ten acres of ground, and within its walls there are buildings which cover 31,346 square yards of ground. There are upwards of 100 furnaces, retorts, or fire-places. The platina vessels in one apartment alone cost upwards of £9000. Messrs. James and William Campbell and Co. retail warehouses, in Candleriggs-street, contain 26,928 square feet of floor. In these premises the public are supplied with every kind of soft goods, and purchasers of a halfpenny lace or a pennyworth of thread are equally attended to as those who make larger purchases; 64 persons attend the customers. The amount of sales in 1831-2 was £312,207. 5s. 8d. Although Messrs. James Morrison and Co., Messrs. Leaf, Son, and Cole, and Mr. Wynn Ellis, of London, turn more money annually, there is no house in the king's dominions, that serves so many customers as Messrs. Campbell's, of Glasgow."—Vol. ii. p. 1001.

RENFREWSHIRE. "The county of Renfrew is second only to the adjoining county of Lanark in the manufacture of cottons and of cotton yarn, extending partially to silk goods. In the town of Paisley (including the Abbey Parish) 6000 males upwards of twenty years of age are thus employed; at Eastwood 737, at Neilston 623, at Kilbrachan 577, at Lochwinnoch (with some mixture of woollen) 275, at Renfrew 212, at Houstoun and Killellan 187, at Cathcart and Mearns about 100 each."—Vol. ii. p. 1022.

The above remarks apply only to the counties where the cotton manufacture is by far the largest branch of manufacturing industry. The whole population of those counties is 2,753,685; in 1750 it was only 791,850,

so that the increase within 80 years has been nearly 2,000,000. Of the present population 649,180 are adult males: of these 173,453, or more than one-fourth, are *directly* employed in manufacture or in making manufacturing machinery. But of all the other classes, except the agricultural labourers, a large proportion are engaged in employments connected with the cotton manufacture, and many of them as closely as the spinners and weavers themselves. It is observed in the Population Returns for Lancashire, that "the column of the abstract which assigns 60,546 males to '*labour not agricultural*,' does not include less than 50,000 of these, in the hundreds of Salford and West Derby, in Manchester and at Liverpool, who assist in various capacities in manufacture, and commerce dependent on manufacture." This remark would no doubt apply to the other counties as well as to Lancashire; so that of 106,228 labourers in all the counties "employed in labour not agricultural," probably 80,000 are engaged in the numberless departments of labour auxiliary to the cotton trade. It is further stated in the notes on Lancashire, that "the column of '*retail trade and handicraft*' includes 86,079 men, of whom a large portion (as may be seen in the above specification) would be attributed to manufacture in other counties, where not placed in competition with the extensive manufactures of Lancashire." It will be seen by the selections made from the trades enumerated as "retail trade and handicraft," in Lancashire, at page 424, that this remark is fully justified; and out of the 181,210 male adults under that column in the cotton counties, a considerable proportion, though I cannot

even conjecture what proportion, must be aiding in this great manufacture. Of the 30,792 "capitalists, bankers, professional, and other educated men," also, a large number must belong to the cotton trade. Less than one-fifth of the male adults of the cotton counties are engaged in agricultural labour: of the remaining four-fifths, by much the larger proportion must be engaged more or less directly in the production or sale of cotton fabrics.

But this is not all. The manufacture is by no means confined to the seven counties enumerated. Thousands of workmen are employed in Yorkshire in the same branch. There are many cotton mills on the Calder, the Aire, and the Wharf, in Saddleworth, the valley of Todmorden, Halifax, Skipton, Keighley, Bingley, Addingham, &c.; and in most of these places weaving is also practised. Cotton is likewise worked, in some of its forms, in parts of Staffordshire, Leicestershire, Gloucestershire, Flintshire, Denbighshire, Westmorland, and Middlesex; in the Scottish counties of Dumbarton, Stirling, Perth, Aberdeen, Ayr, Linlithgow, Dumfries, Bute, and Wigton; and in the Irish counties of Antrim, Armagh, Down, Derry, Dublin, Queen's County, Kildare, Wexford, Waterford, and Cork.

The Population Returns do not include Ireland, where, as appears from the reports of the Factory Inspectors, nearly 5000 operatives are employed in the cotton mills, and where a considerably larger number are employed as hand-loom weavers, calico-printers, bleachers, &c. The Irish cotton trade, though not comparable with that of England or Scotland, has greatly increased of late years,

and is absorbing the hands which have been thrown idle in the linen manufacture by the successful competition of cottons. In 1801, when the cotton manufacturers of Ireland were protected by duties of 68 per cent. ad valorem on grey and white cottons imported, and of 46 per cent. on prints, the quantity of raw cotton imported was only 1,575,789 lbs. A gradual reduction of these miscalled protecting duties brought them down to 10 per cent. in 1816; and the manufacturers declared that this would ruin them; yet in 1817 the import of the raw material had increased to 3,286,429 lbs.; and in 1825 (the last year in which the amount of Irish imports was taken separately) it was not less than 6,768,453 lbs. In the year 1832, one cotton establishment, near Dublin, sent upwards of one hundred thousand pieces of prints to Manchester and London.*

Looking, then, at the information given in the Population Returns concerning the counties where the manufacture chiefly prevails, and at the wide extent of country besides in which it exists in England, Scotland, and Ireland, the conclusion drawn from other data is fully borne out, namely, that at least fifteen hundred thousand persons derive their subsistence from the cotton manufacture.

I reduce the conclusions at which I have arrived, as to the extent and value of the cotton manufacture, into the following tabular form:—

* Mr. W. Stanley's Commentaries on Ireland, p. 162.

EXTENT AND VALUE OF THE BRITISH COTTON MANUFACTURE IN 1833.

Cotton wool imported		*lbs.*	308,656,837
—— —— consumed in the manufacture		*lbs.*	282,675,200
Yarn spun (deducting 1½ oz. per lb. for loss)		*lbs.*	256,174,400
Number of hanks spun (averaging 40 to the lb.)		*hanks*	10,246,976,000
Length of yarn spun (840 yards to the hank)		*miles*	4,890,602,182
Value of the cotton-wool consumed, at 7d per lb.		£	8,244,693
Value of the cotton exports—goods	£13,754,992		
yarn	4,704,008		
	18,459,000		
Value of cotton manufactures consumed at home	12,879,693		
Total value of the manufacture		£	31,338,693
Capital employed in the manufacture		£	34,000,000
Quantity of cotton goods exported (in 1832)—			
White or plain cottons ... *yards*	259,493,096		
Printed or dyed cottons	201,552,407		
		yds.	461,045,503
Number of persons supported by the manufacture			1,500,000
Number of operatives in the spinning and weaving factories ... In England	200,000		
In Scotland	32,000		
In Ireland	5,000		
			237,000
Wages earned by the factory operatives			£6,044,000
Power moving the factories—Steam	33,000 *horses.*		
Water	11,000 ..		
		horse-power	44,000
Number of spindles			9,333,000
Number of power-looms			100,000
Number of hand-loom weavers			250,000
Wages earned by do.			£4,375,000

It may assist to form a conception of the immense extent of the British cotton manufacture when it is stated, that the yarn spun in this country in a year would, in a single thread, pass round the globe's circumference 203,775 times; it would reach 51 times

from the earth to the sun; and it would encircle the earth's orbit *eight and a half* times!

The wrought fabrics of cotton exported in one year would form a girdle for the globe, passing *eleven* times round the equator!

This manufacture furnishes nearly one-half of the exports of British produce and manufactures; it supports more than one-eleventh part of the population of Great Britain; and it supplies almost every nation of the world with some portion of its clothing.

None of the kingdoms of Hanover, Wirtemberg, or Saxony, has a population exceeding that engaged in the manufacture of cotton in this island.

The receipts of our manufacturers and merchants for this one production of the national industry, are equal to two-thirds of the whole public revenue of the kingdom.

To complete the wonder—this manufacture is the creation of the genius of a few humble mechanics; it has sprung up from insignificance to its present magnitude within little more than half a century; and it is still advancing with a rapidity of increase that defies all calculation of what it shall be in future ages.

CHAPTER XVI.

CONDITION OF THE WORKING CLASSES.

INQUIRY into the physical and moral condition of the Operatives in the Cotton Manufacture.—THE FACTORY OPERATIVES.—Their Wages.—Tables of Wages, Prices of Provisions, &c. at Manchester and Glasgow; at the mills of Mr. Thomas Houldsworth, of Manchester, and Mr. Thomas Ashton, of Hyde.—High wages of the factory classes.—Account of Mr. Ashton's establishment.—Objections made to factory labour as unhealthy, severe, and destructive to morals and life, especially to children.—These objections grossly exaggerated.—Popular agitation on the subject.—Factory labour very light, though long continued; not nearly so injurious as many indispensable and common employments.—Prejudices concerning the effect of the steam-engine combated.—Mr. Thackrah's opinion on the unhealthiness of cotton mills; Dr. Kay's.—Evidence to the contrary.—Tables of health of mill operatives.—Medical evidence received by the Factory Commission.—Evidence of the operatives themselves: tables of health of fine spinners.—Testimony of the Factory Inspectors to the health and comfort of the work-people.—Legislative interference to protect children in factories.—Factories Regulation Act of 1833.—Some of its provisions found to be impracticable.—State of morals in factories.—Influence of masters.—Improvements of which the factory system is susceptible.—Other classes of operatives in the manufacture.—HAND-LOOM WEAVERS. Their deplorably low wages: hours of labour.—Tables shewing the decline of weavers' wages at Bolton, Burnley, and Glasgow, from 1795 to 1833.—Occasions and immediate causes of the decline—historical review.—Permanent causes—1st. Easy nature of the employment; 2d. Less confining than factory labour; 3d. Surplus of labour—qualified and explained; 4th. The power-loom.—Proposed Boards of Trade to regulate wages—impracticable; proposed tax on power-looms—absurd.—Desirable to facilitate the abandonment of the hand-loom.—Evils and advantages of large towns.—Intelligence of the manufacturing classes.

WE have seen the effects of the cotton manufacture, in increasing the commerce, population, and wealth of the kingdom, and in adding to the personal and domestic comforts of all classes. The philanthropist and the political philosopher will, however, inquire, what is the physical and moral condition of the vast population employed in this manufacture? The workmen who

construct or attend upon all these machines are not to be confounded with the machines themselves, or their wear and tear regarded as a mere arithmetical question. They are men,—reasonable, accountable men; they are citizens and subjects; they constitute no mean part of the support and strength of the state; on their intelligence and virtue, or their vices and degradation, depend in a considerable measure not only the character of the present age, but of posterity; their interests are as valuable in the eyes of the moralist, as those of the classes who occupy higher stations. Yet the inquiry should be, not if the manufacturing population are subject to the ills common to humanity, not if there is not much both of vice and misery in the crowded towns of Lancashire; but, what is the condition of the working classes of the cotton district, compared with that of the working classes elsewhere? It is the destiny of man to earn his bread by the sweat of his brow; idleness, improvidence, intemperance, and dissoluteness, are found in every community, and are invariably the parents of wretchedness; every where, people of all ages and conditions are liable to disease and death. If our inquiries, therefore, are not discriminating, we may fall into the greatest errors.

The principal considerations will be, the *command which the working classes have over the necessaries and comforts of life*, their *health*, their *intelligence*, and their *morals*.

The *rate of wages* has a very important bearing on the first and second of these considerations. It may be remarked generally, that the smiths, mechanics, joiners, bricklayers, masons, and other artisans, employed in the construction of buildings and machinery for the cotton manufacture, earn excellent wages, work moderate

hours, and have undoubtedly a greater command of necessaries and comforts than at any former period. The spinners, dressers, dyers, printers, power-loom weavers, and all classes of work-people employed in aid of machinery, are also well remunerated for their labour; in the mills, the hours of labour are limited by law to twelve per day, and nine on Saturday *. The hand-loom weavers employed in making plain goods, on the contrary, are in a deplorable condition, both in the large towns and in the villages; their wages are a miserable pittance, and they generally work in confined and unwholesome dwellings.

Much valuable information has been collected within the last eighteen months, by the Factory Commissioners and the Factory Inspectors, illustrative of the condition of the *operatives in cotton factories;* and it is such as to dissipate the clouds of misrepresentation which declaimers had breathed forth on the subject. In regard to the remuneration for their labour, it is established, that no large class of workmen in the kingdom are receiving better wages. The tables given in the last chapter, from the Supplementary Report of the Factory Commissioners, compiled from actual returns bearing every mark of accuracy, state the average weekly net earnings of 48,645 hands (adults and children) in the principal cotton districts of Lancashire and Cheshire, and the average net monthly earnings of 67,819 hands in the same places. It appears that the latter number, including 19,247 men, 20,962 women, and 27,610 children, earned £141,635 in the month ending 4th May, 1833, which is equal to 10s. 5¼d. per week

* The law only prohibits the working of young persons under eighteen years of age more than twelve hours a day in factories; but as such young persons form nearly one-half of the hands, and are employed in many of the operations, the effect is to limit the labour of adults to the same period.

for all the hands indiscriminately, men, women, and children. The respective earnings of the different classes of mill operatives will be seen from the following tables extracted from the same source:—*

AVERAGE NET WEEKLY EARNINGS of the different Classes of OPERATIVES in the COTTON FACTORIES of Manchester, Stockport, Duckenfield, Stayleybridge, Hyde, Tintwistle, Oldham, Bolton, &c. &c., drawn from the returns of 151 mills, employing 48,645 persons, in May, 1833:—

Denomination of Process in which employed.	Class of Operatives.	Classification as respects Age and Sex.	Average Weekly Net Earnings. s. d.
Cleaning and spreading cotton	. . . .	Male and female adults, and some non-adults . . .	8 3
Carding . . .	Carders or overlookers	Male adults . . .	23 6
	Jack-frame tenters .	Principally female adults	8 0
	Bobbin-frame tenters	Do. do. . .	7
	Drawing tenters . .	Do. do. . .	7
Mule-spinning .	Overlookers . . .	Male adults . . .	29 3
	Spinners	Male and female adults, but principally the former .	25 8
	Piecers	Male and female adults and non adults, but principally the latter .	5 4¾
	Scavengers	Male and female non-adults . . .	2 10¾
Throstle-spinning . .	Overlookers . .	Male adults . .	22 4½
	Spinners	Female adults and non-adults . .	7 9
Weaving . . .	Overlookers . . .	Male adults . . .	26 3½
	Warpers	Male and female adults	12 3
	Weavers	Male and female adults, male and female non-adults, but chiefly females	10 10
	Dressers	Male adults . . .	27 9¼
Reeling . . .	Reelers	Female adults and non-adults . . .	7 11¾
Roller covering	Roller coverers . .	Male and female adults	12 1¼
Attending the steam-engine, and making machines . .	Engineers, firemen, mechanics, &c. .	Male adults . . .	20 6

* Supplementary Report of the Factory Commissioners, part i. pp. 124-5. Supplements B and E.

Dr. James Mitchell was employed under the Factory Commission to draw out tables showing the wages, health, &c. of the factory operatives; and the following results were deduced from returns embracing 7,114 operatives in some of the principal cotton mills of Lancashire:—*

WAGES of OPERATIVES in the COTTON-MILLS of Lancashire, specifying their different Ages.

AGE.	MALES.		FEMALES.	
	Number Employed.	Average Weekly Wages.	Number Employed.	Average Weekly Wages.
		s. d.		s. d.
Below 11	246	2 3½	155	2 4¾
From 11 to 16	1,169	4 1¾	1,123	4 3
—— 16 to 21	736	10 2½	1,240	7 3½
—— 21 to 26	612	17 2½	780	8 5
—— 26 to 31	355	20 4½	295	8 7¼
—— 31 to 36	215	22 8½	100	8 9½
—— 36 to 41	168	21 7¼	81	9 8¼
—— 41 to 46	98	20 3½	38	9 3½
—— 46 to 51	88	16 7¼	23	8 10
—— 51 to 56	41	16 4	4	8 4½
—— 56 to 61	28	13 6½	3	6 4
—— 61 to 66	8	13 7	1	6 0
—— 66 to 71	4	10 10	1	6 0
—— 71 to 76	1	18 0	——	——
—— 76 to 81	1	8 8	——	——
	3,770		3,844	

As it is of great interest to know what have been the wages received at former periods as compared with the present, and what the command which those wages relatively gave the workmen over the necessaries and comforts of life, the following statement, compiled by the Chamber of Commerce at Manchester, and published in the Tables of Revenue, &c.,† printed under the direction of the Board of Trade, is introduced:—

* Supplementary Report of the Factory Commissioners, part i. p. 33.

† Tables of Revenue, &c., Part i. p. 165.

A STATEMENT of the Weekly WAGES of LABOUR in the TOWN of MANCHESTER and the other principal Seats of the COTTON MANUFACTURE; with an Account of the Prices of sundry Articles of Provision in the Years 1810 to 1825.

	1810	1811	1812	1813	1814	1815	1816	1817	1818	1819	1820	1821	1822	1823	1824	1825	Remarks.
Provisions.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	
Flour per 12lbs. "Good Seconds"	3 9	3 5	4 9	4 2	2 10	2 7	3 0	4 6	3 5	2 9	2 5	1 11	1 8	2 9	2 0	2 2	
Oatmeal, per do.	2 6	2 6	3 9	3 3	2 4	2 2	2 1	3 2	2 8	2 3	2 1	1 6½	1 4	1 6	1 9	1 9	These are the average retail prices of each year, according to the best information that could be procured.
Potatoes per 20lbs.	—	0 10	11d to 22d	9d. to 15d	0 11	0 11	8d. to 14d	9d. to 17d	0 8½	0 8	0 7½	0 6	0 5½	0 5	0 6	0 7	
Butchers' Meat, per lb.	0 8	0 8	0 8	0 6½	0 9	0 8½	0 7½	0 7½	0 8	0 8	0 7½	0 5½	0 5	0 5	0 5½	0 7½	
Do. do. Coarse pieces	0 6	0 6	0 6	0 6½	0 7	0 6½	0 5½	0 5½	0 6	0 6	0 5	0 3½	0 3	0 3¼	0 4	0 4½	
Bacon per lb.	0 11	0 9	0 10	0 11	0 11	0 10½	0 8	0 7	0 10	0 10	0 8	0 5	0 4½	0 6	0 8	0 8	
Irish Butter, per lb.	1 1	1 2½	1 2	1 1½	1 2½	1 2	0 11	0 11	1 2	1 0	0 10½	0 10	0 9	0 9¼	0 10	0 11	
Cheese	0 8½	0 8½	0 8½	0 9	0 8½	0 8½	0 6¾	0 6¾	0 8	0 8	0 7	0 6½	0 5½	0 5¼	0 6¾	0 7	
Spinning.																	
Fine Spinners	42 6	18 0	30 0	27 0	32 0	32 0	32 0	32 0	32 0	32 0	32 0	32 0	32 0				In the years 1811, 12, and 13, the earnings of a part of the spinners were reduced by a restricted allowance of work, and not by a reduced state of wages.
Coarse Do.	Will run from 20s. to 28s. per Week during the whole of the time.													25 6	25 6	25 6	
Women Do.	—	—	15 7	14 2	17 0	17 0	17 0	17 0	17 0	17 0	17 0	17 0	17 0	16 9	16 9	16 9	
Reelers	12 0	6 0	9 11	8 2	10 0	10 0	10 0	10 0	10 0	10 0	10 0	10 0	10 0	10 0	10 0	10 0	
Stretchers	15 6	8 5	13 5	11 8	14 0	14 0	14 0	14 0	14 0	14 0	14 0	14 0	14 0	17 6	17 6	17 6	
Pickers	11 3	5 6	10 1	8 8	10 0	10 0	9 0	9 0	9 0	9 0	9 0	9 0	9 0	7 0	7 0	7 0	
Weaving by Hand.																	
Nankeens	16 3	12 6	13 0	12 6	15 7	13 2	13 2	9 6	9 6	9 6	11 0	11 0	11 0	6 6	6 6	6 6	These are the net earnings of weavers, taken on the average of each year, after deducting 2½ pence in the shilling for winding the weft, flour, &c., used in dressing the warp, and other outgoings. Of these deductions the greater part is for winding, which is generally done in the family. The principal articles of manufacture, and the earnings of men of ordinary skill, working 12 hours per day, have formed the basis of this statement. A considerable portion of the weaving of plain goods is performed by women and children, and their earnings will be according to their strength and skill.
Best 74 ⅞ Calicoes	—	9 6	11 4	12 8	13 8	10 10	9 2	8 4	9 8	8 3	8 3	8 4	8 0	4 6	4 6	4 3	
Third Do.	—	—	6 8	6 8	15 3	11 8	8 1	6 4½	8 1	6 0	8 0	8 0	7 6	4 6	4 6	4 3	
Strong 9-8ths. Do.	13 0	8 9	9 7	8 9	11 4	8 9	7 4	6 1	7 0	7 0	9 0	9 0	8 8	5 0	5 0	4 8	
Velveteens	12 0	10 10	9 0	8 5	10 10	10 4	7 8	5 7½	6 1	8 9	8 9	8 10	10 6	7 0	7 0	6 6	
Bolton Cambrics, 60 Reed	16 10½	9 4	9 5	10 8	15 4	10 5	8 4	6 4	8 0	7 8	7 5	7 0	6 9	7 0	7 0	6 3	
Manchester Do. 80	14 0	10 9	10 3	11 1	16 9	10 3	8 3	6 9	8 10	7 9	7 6	7 3	7 0	7 6	7 6	6 6	
Quiltings, 36	16 5½	12 7	9 6	11 5	15 0	13 0	11 11	9 8	9 8	9 8	8 6 }	11 6	10 0	7 0	7 0	6 6	
Do. fine	17 2	14 9	14 0	14 0	18 0	18 3	15 6	11 1	11 0	11 3	10 0 }			9 0	9 0	8 6	
Fancy Articles	21 0	14 8	14 2	15 6	20 0	18 3	12 2	9 5	11 9	10 3	11 0	10 0	9 6	8 6	8 6	8 0	
Printing and Bleaching.																	
Calico Printers	26 0	26 0	26 0	26 0	26 0	26 0	26 [illegible]	26 0	26 0	26 0	26 0	30 [illegible]	31 5	28 9	20 6	17 6	
Bleachers and Finishers	18 6	18 0	18 6	18 6	18 6	18 6	18 6	18 6	18 6	18 6	18 6	17 6	16 6	17 6	21 6	21 6	
Fustian Cutters	14 0	14 0	14 0	14 0	14 0	14 0	14 0	14 0	14 0	14 0	14 0	10 0	9 0	16 0	16 0	21 0	
Warpers	16 0	16 0	16 0	16 0	16 0	16 0	16 0	16 0	16 0	16 0	16 0	18 0	18 0	16 0	16 0	16 0	
Dyers and Dressers	15 0	15 0	15 0	15 0	15 0	15 0	15 0	15 0	15 0	15 0	15 6	14 6	14 0	16 9	16 3	17 6	
Tailors	18 6	18 6	18 6	18 6	18 6	21 6	21 6	21 6	18 6	18 6	18 6	18 6	18 6	21 0	21 0	21 0	
Porters	18 0	18 0	18 0	18 0	18 0	18 0	18 0	18 0	18 0	18 0	18 0	18 0	18 0	15 0	15 0	15 0	
Packers	20 0	20 0	20 0	20 0	20 0	20 0	20 0	20 0	20 0	20 0	20 0	20 0	20 0	21 0	21 0	21 0	
Shoemakers	16 0	16 0	16 0	16 0	16 0	16 0	16 0	16 0	16 0	16 0	—	23 0	18 0	16 0	16 0	16 0	
Ironfounders	31 3	28 0	27 4	31 6	32 3	32 1	34 8	33 8	35 10	31 6	Not much, if any alteration from the former Report.	30 6	30 6	30 0	30 0	30 0	
Whitesmiths	25 0	25 0	25 0	25 0	25 0	25 0	25 0	25 0	25 0	25 0		27 0	27 0	27 0	27 0	27 0	
Sawyers	25 0	25 0	25 0	25 0	25 0	25 0	25 0	25 0	25 0	25 0		30 0	30 0	25 0	25 0	25 0	
Carpenters	25 0	25 0	25 0	25 0	25 0	25 0	25 0	25 0	25 0	[illegible] 0		25 0	26 0	22 0	22 0	24 0	
Stonemasons, allowing for Winter	22 0	22 0	22 0	22 0	22 0	22 0	22 0	22 0	22 0	22 0		24 0	26 0	22 0	22 0	24 0	By "Fancy Goods" is meant, figured patterns, where the mounting the loom is a considerable expense to the workman.
Bricklayers	22 6	22 6	22 6	22 6	22 6	22 6	22 6	22 6	22 6	22 6		22 6	25 0	21 0	21 0	24 0	
Painters	22 0	22 0	22 0	22 0	22 0	22 0	22 0	22 0	22 0	22 0		22 0	22 0	20 0	22 0	22 0	
Slaters	21 0	21 0	21 0	21 0	21 0	21 0	21 0	21 0	21 0	21 0		21 0	21 0	18 0	18 0	21 0	
Plasterers	19 0	19 0	19 0	19 0	19 0	19 0	19 0	19 0	19 0	19 0		20 0	21 0	20 0	20 0	21 0	
Bricklayers' Labourers	15 9	15 9	15 9	15 9	15 9	15 9	15 9	15 9	15 9	15 9		—	—	14 0	14 0	16 0	

The following tables, from the same source as the last,* bring down the information to the year 1832:—

STATEMENT of the PRICES of PROVISIONS in the Town of MANCHESTER, in each Year, from 1826 to 1832, both inclusive.

	1826	1827	1828	1829	1830	1831	1832
	s. d.	s. d.	s. d	s. d.	s. d.	s. d.	
Beef, best* . per lb.	0 6½	0 6	0 6½	0 6	0 5½	0 6	
—— coarse	0 4¾	0 4	0 4	0 3¾	0 3	0 3½	
Bacon	0 7½	0 8	0 7½	0 7½	0 6½	0 7	0 7
Bread Flour . per 12lbs.	2 5	2 5	2 7	2 9	2 7	2 6	2 4
——, Wheaten . per lb.	—	—	0 1¾	0 2	0 2	0 1¾	0 1¾
Cheese	0 7½	0 7½	0 8	0 6½	0 7½	0 8	0 7½
Malt . . . . per 9 lbs	2 1	2 4	2 2	2 2	2 1	2 4	2 2
Meal . . . per 10 lbs.	1 7½	1 8½	1 7	1 5	1 6	1 6	1 3
Potatoes† . per 252 lbs	9 9	4 9	5 8	6 6	6 0	6 3	4 3
Pork . . . . per lb.	0 6¾	0 7	0 6¼	0 6¼	0 5	0 5½	0 5½

* Contract Prices at the Royal Infirmary † Contract Prices at the Workhouse
The other Prices are such as were charged by Retail Shopkeepers.

STATEMENT of the WEEKLY RATES of WAGES paid to the undermentioned Description of Workmen in MANCHESTER, in the Year 1832.

	s. d.		s. d.
Spinners, Men .	20 0	to	25 0
.. Women	10 0	..	15 0
Stretchers . .	25 0	..	26 0
Piecers (Boys and Girls)			
Scavengers . .			

IN THE CARD ROOM.

	s. d.		s. d.
Men	11 6	..	17 0
Young Women .	9 0	..	9 6
Children . .	6 0	..	7 0
Throstle Spinners	5 0	..	9 6
Reelers . . .	7 0	..	9 0

WEAVERS BY POWER.

	s. d.		s. d.
Men . .	13 0	..	16 10
Women . .	8 0	..	12 0
Dressers, Men	28 0	..	30 0
Winders and Warpers .	8 0	..	11 0
Mechanics . . .	24 0	..	26 0

WEAVING BY HAND.

	Quality	Woven by	s. d		s d
Nankeens,	Fancy .	Men . .	9 0	to	15 0
..	Common .	Children or Women .	6 0	.	8 0
..	Best . .	Men . .	10 0	.	13 0
Checks,	Fancy .	Men . .	7 0	.	7 6
..	Common .	Children .	6 0	..	7 0
Cambrics	.	All ages .	6 0	..	6 6
Quiltings	.	Men and Women .	9 0	.	12 0
Fustian Cutters, all ages . .			10 0	.	12 0
Machine Makers, Men . . .			26 0	.	30 0
Iron Founders, Men . . .			28 0	.	30 0
Dyers & Dressers, Men . . .			15 0	.	20 0
...		Young Men .	12 0	.	14 0
...		Boys . . .	5 0	.	10 0
Tailors, Men			18 0		
Porters			14 0	.	15 0
Packers			20 0		
Shoemakers			15 0	.	16 0
Whitesmith			22 0	.	24 0
Sawyers			24 0	.	28 0
Carpenters			24 0		
Stone Masons			18 0	.	22 0
Bricklayers			17 0	.	20 0
Bricklayers' Labourers . . .			12 0		
Painters			18 0		
Slaters			3 6	per day.	
Plasterers			19 0	to	21 0
Spademen.			10 0	..	15 0

* Tables of Revenue, &c. Part ii. p. 101.

Let us now examine the remuneration obtained by the factory workmen in the great seat of the Scotch cotton manufacture, Glasgow. It has been seen that the average wages of the factory operatives of Lancashire and Cheshire, including men, women, and children, are within a fraction of 10s. 6d. per week. According to returns, in 1833, from twenty-nine spinning mills in Glasgow and the neighbourhood, employing 5,273 hands, it appears that the average wages of men, women, and children were 8s. 1½d. The difference is chiefly owing to a greater proportion of women and children being employed here than in Manchester: of the 5,273 individuals, 3,260 are under eighteen years of age, and only 1,311 are twenty-one years or upwards. The average wages of the men are 21s. 11d.; the average wages of the youngest children 2s.* In Lancashire there is nearly an equal number of males and females in the mills; but in a subjoined return from the Glasgow mills, the numbers are, 4,631 males, and 7,445 females. In Scotland, also, the habits of the working population are more frugal than in England, and their food of a cheaper kind; which accounts for wages being somewhat lower.

A table was drawn out by Dr. Mitchell for Glasgow, like that which has been quoted for Lancashire:—†

* Letter to Lord Ashley, on the Cotton Factory System. By Kirkman Finlay, Esq.

† Supplementary Report of the Factory Commissioners, part i. p. 33.

Wages of Operatives in the Cotton Mills of Glasgow, specifying their different Ages.

AGE.	Males.		Females.	
	Number employed.	Average Weekly Wages.	Number employed.	Average Weekly Wages.
		s. d.		s. d.
Below 11	283	1 11¾	256	1 10¼
From 11 to 16	1519	4 7	2162	3 8¾
— 16 — 21	881	9 7	2452	6 2
— 21 — 26	541	18 6	1252	7 2¼
— 26 — 31	358	19 11¼	674	7 1
— 31 — 36	331	20 9	255	7 4½
— 36 — 41	279	19 8½	218	6 7½
— 41 — 46	159	19 6	92	6 6
— 46 — 51	117	19 2	41	6 10
— 51 — 56	60	17 9¾	18	6 1½
— 56 — 61	45	16 1¼	16	6 0
— 61 — 66	17	17 7	7	5 5
— 66 — 71	15	15 9½	2	4 9
— 71 — 76	11	10 11	—	—
— 76 — 81	5	9 6	—	—
— 81 — 86	—	0 0	—	—
— 86 — 91	1	8 0	—	—
	4631		7415	

The "Tables of Revenue, Commerce,"&c.,* contain the following statement, compiled by Dr. Cleland :—

DAILY WAGES of Persons employed in the COTTON MILLS of Glasgow and its Neighbourhood, in April, 1832.

Work and Wages of Cotton Spinners	Fine Numbers.	Coarse Numbers
Men on piece-work . .	At wheels containing from 252 to 300 spindles, earn 4s. 6d. per day	At wheels from 180 to 300 spindles, earn 3s. 6d. to 4s. 6d. per day.
Women reelers and winders	Earn 1s. 4d. per day .	Earn 1s. 2d. per day.
Lads and girls employed in the preparation-room, or as piecers to the spinners, and paid by the day	From 14 to 17 years of age, earn 1s. 4d. per day	Do. do.
Children do do. do	From 10 to 14 years years of age, earn 10d. per day	Earn 8d. per day.
Do. do. do. do.	Under ten years of age earn 5d. per day	Earn 4d. per day.
Lads and Girls	. . . .	At wheels from 120 to 180 spindles, earn from 2s. to 3s. per day.

"REMARKS.—The wages of cotton-spinners did not vary during the 10 years preceding 1820, and very little since that period.

"The prices quoted are all net to the workers.

"The hours of labour in Glasgow and the vicinity used to be 12½, but since the restrictive acts of parliament of 1818-19 the period has been reduced to 12 hours. The former acts regarding whitewashing and cleanliness are scrupulously attended to."

Tables will now be given, shewing the earnings of different classes of workmen, at different periods from

* Part ii, p. 108.

1804 to 1833, in two first-rate cotton mills, one in Manchester, and the other at Hyde. The first, though applying directly to only a small class of workmen, viz. the fine spinners, contains much information in small space, and presents conclusions applicable in some degree to other branches of business:—

WAGES and WORK of FINE COTTON SPINNERS, at different periods, from the Wages-Books of Mr. Thomas Houldsworth, of Manchester.*

Years	Work turned off by one spinner per week		Wages per Week.			Hours of Work per Week.	Prices from Greenwich Hospital Records.		Quantities which a Week's net Earnings would purchase.	
	lbs	Nos	Gross	Piecers	Net		Flour per sack	Flesh per lb.	lbs. Flour	lbs Flesh.
			s. d.	s. d.	s. d.		s. d.	d. d.		
1804	12	180	60 0	27 6	32 6	74 sup.	83 0	6 to 7	117	62½
——	9	200	67 6	31 0	36 6	74 sup.	83 0	6 to 7	124	73
1814	18	180	72 0	27 6	44 6	74	70 6	8	175	67
——	13½	200	90 0	30 0	60 0	74	70 6	8	239	90
1833	22½	180	54 8	21 0	33 8	69	45 0	6	210	67
——	19	200	65 3	22 6	42 9	69	45 0	6	267	85

"The sack of flour is taken at 280 lbs.

"The above is the result of an average of several men's work, at the different periods.

"There are 111 spinners at present employed in the mill; their average net earnings is 33s. 3d. each per week. There are in the same mill 917 persons employed in card-rooms, doubling, reeling, and piecing; their net earnings now average 7s. 1d. per week. To shew the rate of wages at different periods in these departments, the following table has been obtained from the wages-books of the concern:—

* This and the following table are taken from the Report of the Commons' Committee on Manufactures, Commerce, and Shipping, pp. 319, 320.

WAGES OF CARDERS, REELERS, AND DOUBLERS, AT DIFFERENT PERIODS.

Years		1806		1811		1815		1818		1824		1833	
		s.	d.	s.	d	s.	d.	s.	d.	s.	d.	s.	d.
Card-room	Males	15	0	15	0	16	6	15	0	15	0	15	0
....	..	17	0	17	0	18	6	18	0	17	9	17	9
....	..	35	0	35	0	40	0	40	0	40	0	30	0
....	Females	9	0	9	0	10	0	9	0	9	0	9	0
Reelers	....	19s to 30s		15	0	15	0	15	0	15	0	12	0
Doublers	....	12	0	10	6	10	6	9	6	9	6	8	6

"Piecers' wages, with the exception of those of big piecers, who constitute one-third of the whole, have not varied sixpence per week within the last twenty years. Big piecers' wages are now 8s. 6d. to 9s. 6d.; they were, in 1814, from 9s. 6d. to 10s. 6d.

"Mechanics' wages, blacksmiths, turners, filers, machine makers, and fitters-up, are now from 27s. to 31s. per week. Within the last twenty years they have been as high as 28s. to 35s.; but then they worked half an hour to one hour per day longer."

The following tables were furnished to me by Mr. Thomas Ashton, of Hyde, and have since been communicated by him to the Factory Commissioners, and published in their reports. No one can see without admiration the extensive and admirably-managed works of Mr. Ashton, whose work-people display, both in their persons and their dwellings, as much of health, comfort, and order as can, perhaps, be found in any equal number of the operative classes in the kingdom :—

A STATEMENT of the clear average EARNINGS of SPINNERS, DRESSERS, and WEAVERS, in the employ of Mr. Thomas Ashton, of Hyde, in the county of Chester, cotton manufacturer, in the years undermentioned.

Years.	Description.		Weekly Average. £. s. d.
1816	Spinners,	1st class	1 17 0
..	..	2d & 3d do.	1 10 0
..	Dressers		1 10 0
..	Weavers*		0 14 0
1821	Spinners,	1st class	1 15 6
..	..	2d & 3d do.	1 7 3
..	Dressers		1 10 0
..	Weavers		0 14 0
1826	Spinners,	1st class	1 15 0
..	..	2d & 3d do.	1 7 0
..	Dressers		1 10 0
1826	Weavers		0 13 0
1831	Spinners,	1st class†	1 14 9
..	..	2d & 3d do.	1 8 0
..	..	4th do.	0 19 8
..	Dressers		1 10 6
..	Weavers		0 12 0
1832	Spinners,	1st class	1 15 0
..	..	2d & 3d do.	1 8 2
..	..	4th do	1 0 0
..	Dressers		1 10 6
..	Weavers		0 12 0

* The weavers, all of whom are employed in attending the power-loom, are for the most part young girls.

† In this and the following year, the total number of hands in Mr Ashton's employ, was twelve hundred, and their average earnings amount to twelve shillings weekly for every description of hands, fifty-two weeks in each year.

AVERAGE PRICES paid by Messrs Ashtons, of Hyde, for WEAVING 72⅞ Power Loom Calico, for each piece of 28 yards; and for Uplands and Brazil Cotton per pound, from which the same are made; with the average Market Price for which such pieces sold in the years undermentioned.

Years	Weaving per Piece. s. d.	Cotton per Pound. s. d.	Market Price per Piece of 28 yds. £. s. d.	Years	Weaving per Piece. s. d.	Cotton per Pound. s. d.	Market Price per Piece of 28 yds. £. s. d.
1814	3 0	2 6	1 8 0	1824	1 8	0 10¼	0 14 0
1815	3 0	1 8	1 5 6	1825	1 8	1 2	from 14 0
1816	2 6	1 8	1 2 0				to 18 6
1817	2 6	1 10	1 0 7½	1826	1 6	0 8	0 10 6
1818	2 6	1 10	1 1 1½	1827	1 6	0 7½	0 10 3
1819	2 0	1 2	0 17 8	1828	1 4	0 7	0 10 2
1820	2 0	1 1	0 15 0¾	1829	1 4	0 6¾	0 8 9
1821	1 8	0 11	0 15 8¾	1830	1 4	0 6½	0 8 3
1822	1 8	0 10	0 14 6	1831	1 4	0 6½	0 8 9
1823	1 8	0 10½	0 14 5				

The eleven tables now given establish beyond all controversy that the 237,000 work-people employed in the cotton-mills of Great Britain are in the receipt of wages amply sufficient to yield them not merely the necessaries of life in food, clothing, and habitation, but also many comforts and some superfluities,—to enable the adult workmen, with proper management and frugality, to educate their children, and to provide against sickness and old age,—and to admit of children contributing materially to the support of necessitous parents. Where a spinner is assisted by his own children in the mill, as is very frequently the case, his income is so large that he can live more generously, and clothe himself and his family better, than many of the lower class of tradesmen; and, though improvidence and misconduct too often ruin the happiness of these families, yet there are thousands of spinners in the cotton districts who eat meat every day, wear broad cloth on the Sunday, dress their wives and children well, furnish their houses with mahogany and carpets, subscribe to publications, and pass through life with much of humble respectability.

Wages, it will be seen, have declined in nominal amount since the war, but not so much as the prices of provisions and clothing; so that the workmen are now receiving higher real wages than at any former period. The rate of payment has in many cases been reduced on a given quantity of work, yet without diminishing the receipts of the workmen—the improvements in machinery enabling them to throw off a greater quantity of work in the same time, and thus compensating for the reduced rate of payment. For instance, it appears

from the last table that the power-loom weaver was paid 3s. per piece in 1814, and only 1s. 4d. per piece in 1832; but such was the improvement in the power-loom between those periods, that, instead of receiving less than one-half the money wages, his receipts per week only declined from 14s. in 1814, to 12s. in 1832—the latter sum at this time being higher real wages than the former sum at the close of the war. Owing to the improvement in the dressing-machine, the dressers received higher wages in 1833, when they were paid 3d. a cut, than they received many years before, when they were paid 10d. a cut.

Allusion has been made to the establishment of Mr. Thomas Ashton, at Hyde. Of this establishment, a very pleasing account has been published by a physician in Manchester, to the accuracy of which I can bear personal testimony; and as the particulars shew what has been done by a humane and enlightened manufacturer for the happiness of his work-people, and what means the cotton trade affords to elevate the condition of the operatives who work with machinery, the example deserves to be held up for the emulation of other manufacturers. It also presents a most striking specimen of the effects of the cotton trade, in increasing the population and wealth of the country:—

"Twelve hundred persons are employed in the cotton factories of Mr. Thomas Ashton, of Hyde. This gentleman has erected commodious dwellings for his work-people, with each of which he has connected every convenience that can minister to comfort. He resides in the immediate vicinity, and has frequent opportunities of maintaining a cordial association with his operatives. Their houses are well furnished, clean, and their tenants exhibit every

indication of health and happiness. Mr. Ashton has also built a school, where 640 children, chiefly belonging to his establishment, are instructed on Tuesday in reading, writing, arithmetic, &c. A library, connected with this school, is eagerly resorted to, and the people frequently read after the hours of labour have expired. An infant school is, during the week, attended by 280 children, and in the evenings others are instructed by masters selected for the purpose. The factories themselves are certainly excellent examples of the cleanliness and order which may be attained, by a systematic and persevering attention to the habits of the artisans.

"The effects of such enlightened benevolence may be, to a certain extent, exhibited by statistical statements. The population, before the introduction of machinery, chiefly consisted of colliers, hatters, and weavers. Machinery was introduced in 1801, and the following table exhibits its consequences in the augmentation of the value of property, the diminution of poor-rates, and the rapid increase of the amount assessed for the repairs of the highway, during a period in which the population of the township increased from 830 to 7138 :—

Township of Hyde, in the Parish of Stockport, in the County of Chester.

Year	Estimated Value of Property assessable to the Poor's rate.		Sums assessed for the Relief of the Poor.			Sums assessed for the Repairs of the Highway.			Population.	Remarks.
	£.	s.	£.	s.	d.	£.	s.	d.		
1801	693	10	533	12	0	2	11	6	830	Machinery introduced.
2	697	0	391	19	4	51	19	5		
3	697	0	336	8	0	52	3	0¾		
4	697	10	325	10	0	52	5	9¼		
5	724	0	385	17	4	100	6	11½		
6	786	0	339	6	0	110	12	11½		
7	829	0	276	4	8	172	7	9½		
8	898	10	223	1	1	177	6	10		
9	915	0	286	16	8	152	17	9		
1810	935	0	345	10	0	116	18	3½		
11	915	10	117	6	4	199	19	3½	1806	
12	975	15	471	8	4	168	11	1		Riots, machinery broken
13	956	0	687	7	8	118	18	11¼		in various places. Pow-
14	997	0	630	6	8	144	18	8¼		er-looms introduced.
15	1029	15	508	18	0	99	9	3½		
16	1079	5	390	2	0	156	9	5¼		
17	1109	15	502	3	6	150	2	8½		
18	1112	0	121	2	0	171	15	9		
19	1212	0	131	6	0	201	8	7½		
1820	1272	0	355	1	8	229	11	7		
21	1371	15	274	7	0	265	1	1	3355	New county-rate made:
22	1129	5	435	10	6	110	12	0¼		from this time the county-
23	1570	0	179	8	0	454	8	8¼		rate, together with the
24	1792	0	318	17	0	506	2	2½		salary of the serving offi-
25	1957	0	398	11	0	521	19	3¼		cer, averages £200 per
26	2093	10	138	7	6	573	10	7¼		annum.
27	2351	15	479	6	3	598	10	5		
28	2533	0	502	7	1	732	1	3¾		
29	2623	0	790	11	9	681	19	6½		
1830	2727	0	519	16	0	578	10	1		Vestry built this year.
31	2783	0	*834	18	9	359	5	5½	7138	
Total in 31 years			13,991	13	7	8,105	19	7		
Average . . .			451	10	0	271	7	2		

"This table exhibits a cheering proof of the advantages which may be derived from the commercial system, under judicious management. We feel much confidence in inferring, that where

* A considerable balance in the overseer's hands.

so little pauperism exists, the taint of vice has not deeply infected the population; and concerning their health, we can speak from personal observation. The rate of mortality, from statements* with which Mr. Ashton has politely furnished us, appears to be exceedingly low. In thirteen years (during the first six of which, the number of rovers, spinners, piecers, and dressers was one hundred, and during the last seven, above two hundred,) only eight deaths occurred, though the same persons were, with rare exceptions, employed during the whole period. Supposing, for the sake of convenience, that the deaths were nine; then, by ascribing three to the first six years, and six to the last seven, the mortality during the former period was one in 200, and during the latter, one in 233. The number of weavers during the first six years was 200, and during the last seven 400, and in this body of workmen 40 deaths occurred in thirteen years. By ascribing thirteen of these deaths to the first six years, and twenty-seven to the last seven, the mortality, during the former period, was one in 92, and during the latter, one in 103.

"These facts indicate that the present hours of labour do not

* "Minute of deaths among the spinners, piecers, and dressers, employed at the works of Mr. Thomas Ashton, in Hyde, from 1819 to 1832, 13 years, viz. Spinners. [illegible] Robinson, [illegible] Seville, David Cordingley, [illegible] Piecers. Jas. Rowbotham, Wm. Green. Dressers. John [illegible] Samuel Broadhurst.

"There are employed at these works 61 rovers and spinners, 120 piecers, and 38 dressers, total 219; among whom there are at this time 10 spinners whose ages are respectively from forty up to fifty-six years, and among the dressers there are 12 whose ages are equal to that of the above spinners. We have no orphans at this place, neither have we any family receiving parochial relief, nor can we recollect the time when there was any such. The different clubs or [illegible] among the spinners, dressers, overlookers, and mechanics employed here, allow ten or twelve shillings per week to the members during sickness, and from six to eight pounds to a funeral, which applies also to the member's wife, and in some cases, one half or one fourth to the funeral of a child. The greatest amount of contributions to these funds have in no one year exceeded five shillings and six pence from each member.

"The weavers (chiefly young women) have also a funeral club, the contributions to which are four pence per member to each funeral. In the above period of thirteen years, there have happened among them only forty funerals.

"The number of persons employed, twelve hundred, who maintain about two thousand.

"Hyde, 27th March, 183[illegible]." "JOSEPH TINKER, Book-keeper."

injure the health of a *population otherwise favourably situated;* but that, when evil results ensue, they must chiefly be ascribed to the combination of this *with other causes of moral and physical depression.*"*

Mr. Ashton's is far from being a solitary case. He himself has informed me that he does not consider his establishment materially different, as regards the wages, comforts, and health of the work-people, from many others at Hyde, Ashton, Duckenfield, Stayley-bridge, &c. In this district, however, the first quality of yarn is spun, and, on the whole, the best wages paid.

But it has been represented by declamatory writers, and even by some parliamentary orators, that the high wages of the cotton spinners are earned by the entire sacrifice of health and comfort,—that the labour of the mill is so severe, incessant, and prolonged, as to destroy the constitution and to exhaust the mental energies of the workmen,— that they breathe a heated and polluted atmosphere, loaded with dust and fibres of cotton, which, entering the lungs, soon produce consumption,—that the exhaustion of their bodies by labour drives them to intemperance as a relief and a stimulus,—that thus their lives are passed in an alternation of depressing drudgery and maddening excitement, without any healthy exercise of the mental faculties, or any rational enjoyment. It is pretended that the mill operatives are placed in cruel competition with machinery, whose relentless speed strains their faculties to the utmost, admits not of a moment's intermission from toil, makes no allowance for human feebleness, but unnaturally taxes flesh and sinews

* The Moral and Physical Condition of the Working Classes employed in the Cotton Manufacture in Manchester. By James Phillip Kay, M.D. 2d edition. pp. 100 – 101

to keep pace with wheels and arms of iron. By these rhetoricians, the steam-engine is represented as a tyrant power, and a curse to those who work in conjunction with it. Above all, it is alleged that the children who labour in mills are the victims of frightful oppression and killing toil,—that they are often cruelly beaten by the spinners or overlookers,—that their feeble limbs become distorted by continual standing and stooping, and they grow up cripples, if indeed they are not hurried into premature graves,—that in many mills they are compelled to work thirteen, fourteen, or fifteen hours per day,—that they have no time either for play or for education,—and that avaricious taskmasters, and idle, unnatural parents, feed on the marrow of these poor innocents. To such representations it is an appropriate finish to call the factories, as has often been done, hells upon earth.

Views such as these have been repeatedly given of factory labour, with an amplification of detail and a strength of language, which have induced many to think they must be true. A year or two ago, the subject became one of powerful agitation among the working classes of the manufacturing districts, being made so chiefly by a few individuals, who were mainly, though not altogether, influenced by humane motives, but whose imagination and feelings were much stronger than their judgments. These individuals maintained, with apparent reason, that no child ought to work more than ten hours per day, and that the mills, which then worked eleven, twelve, and in some cases even longer, should be prevented by law from working more than ten hours. A cause in itself good, was injured by the outrageous violence and unreasonable demands of its pro-

moters, who continually presented the most hideous caricatures of the effects of factory labour, reviled the mill-owners as monsters, and shewed themselves perfectly blind to the effect which so great a restriction on industry must produce on our foreign trade, and on the earnings of the workmen. The latter, with few exceptions, united in the clamorous demand for a "ten hours bill;" not because they believed that the children were oppressed, but because they ignorantly imagined their own labour would be shortened by such a bill from twelve hours to ten, without any reduction being made in their wages. This ridiculous delusion was inculcated by the leaders of the outcry, who treated our foreign trade as of no importance, and as rather an injury than a benefit to the country,—thus evincing inconceivable ignorance and folly, and proving themselves utterly unfit to legislate for the vast manufacturing interests of Britain. For a while, however, declamation prevailed. A Committee of the House of Commons was appointed to inquire into the effects of factory labour on children: and a mass of *ex parte* evidence was received, which was full of the grossest exaggerations and mistatements.

The investigations made by the Factory Commissioners, who the next year examined many of the mills, and questioned the workmen, and still more those of the Factory Inspectors appointed the same year, who have visited nearly every mill in the country, have amply proved that the views above mentioned, of the nature and effects of labour in mills, contain but a very small portion of truth. That there have been instances of abuse and cruelty in some of the manufacturing establishments, is doubtless true; that the labour is not so healthful as labour in husbandry, must be at once admitted; and

some children have unquestionably suffered from working beyond their strength. But abuse is the exception, not the rule. Factory labour is far less injurious than many of the most common and necessary employments of civilized life. It is much less irksome than that of the weaver, less arduous than that of the smith, less prejudicial to the lungs, the spine, and the limbs, than those of the shoemaker and the tailor. Colliers, miners, forgemen, cutlers, machine-makers, masons, bakers, corn-millers, painters, plumbers, letter-press printers, potters, and many other classes of artisans and labourers, have employments which in one way or another are more inimical to health and longevity than the labour of cotton mills. Some classes of professional men, students, clerks in counting-houses, shopkeepers, milliners, &c., are subject to as great, and in many cases to much greater, confinement and exhaustion, than the mill operatives.

The human frame is liable to an endless variety of diseases. Many of the children who are born into the world, and who attain the age of ten or twelve years, are so weakly, that under any circumstances they would die early. Such children would sink under factory labour, as they would under any other kind of labour, or even without labour. But it is no reasonable ground of objection to this or to any other employment, that it is unsuited to delicate and infirm persons. If we would abandon every occupation which may accelerate the natural tendency to disease or decay, the most indispensable occupations of civilized men must be given up. The works of medical writers shew us that there is no trade or occupation which might not be injurious to persons subject to one kind of weakness or another. A

man who hesitated in his choice of a trade till he found one which was free from all objection, would starve before he had decided how he should live. Labour is the condition of subsistence; but there are many constitutions which cannot sustain labour: this, then, is an evil of our destiny as men, and is not a ground of complaint against necessary occupations. Food cannot be obtained without toil, but toil is a less evil than hunger: clothing cannot be made without exertion and application, but these are to be endured rather than nakedness. A physician might, if so disposed, get up a case against any employment of civilized or savage life, sufficient to excite public sympathy and abhorrence; but so long as men cannot live without working, they must work in spite of inconvenience.

These obvious truths, so nearly approaching to truisms, would not have been presented to my readers, if they had not been absolutely forgotten by many of the declaimers on factory labour, who have thought it sufficient to collect a few instances of deformity and injury out of nearly half a million of work-people in the cotton, woollen, flax, and silk mills of Great Britain, and have then leaped to the conclusion, that their labour was dreadfully pernicious. I do not deny that such instances have occurred, but I confidently deny that they have been in such numbers as to warrant the conclusion drawn from them.

In opposing one error, I shall endeavour not to fall into an opposite error. I am far from contending, that the labour of mills is of the most agreeable and healthful kind; or that there have not been abuses in them, which required exposure and correction; or that legislative interference was not justifiable, to protect children

of tender years from being overworked. It must be admitted that the hours of labour in cotton mills are long, being twelve hours a day on five days of the week, and nine hours on Saturday; but the labour is light, and requires very little muscular exertion. Attention and gentle exercise are needed; the greater number of operatives are employed in clearing the cotton from the cards,—shifting the cans at the drawing frames,—removing and replacing bobbins at the roving frames, throstles, and mules,—piecing the threads which break at those machines,—sweeping up the waste cotton,—adjusting the cloth in the power-looms,—winding, warping, and dressing the warp. The severest labour in mills is that of the women who clean the cotton by beating it with wands, but this is only in the fine spinning mills, machines being used for the purpose where the lower numbers are spun. The work of the spinners, who are adult males, requires moderate exertion and great care. 'It is not true to represent the work of the piecers, doffers, &c., as continually straining the faculties. None of the species of work in which children and young persons are engaged in mills require constant attention; most of them admit even of the attention being remitted every few minutes; and where the eye must be kept on the watch, habit makes the task of observation perfectly easy. It is scarcely possible for any employment to be lighter. The position of the body is not injurious: the general attitude is erect, but the children walk about, and have opportunity of frequently sitting if they are so disposed. On visiting mills, I have generally remarked the coolness and equanimity of the work-people, even of the children, whose manner seldom, as far as my observation

goes, indicates anxious care, and is more frequently sportive than gloomy. The noise and whirl of the machinery, which are unpleasant and confusing to a spectator unaccustomed to the scene, produce not the slightest effect on the operatives habituated to it.

The only thing which makes factory labour trying even to delicate children is, that they are confined for long hours, and deprived of fresh air: this makes them pale, and reduces their vigour, but it rarely brings on disease. The minute fibres of cotton which float in the rooms, and are called *fly*, are admitted, even by medical men, not to be injurious to young persons: it might have been supposed that they would have impeded respiration, or irritated the bronchial membrane, but extensive observation proves that they do so in very few cases. Workmen of more advanced years occasionally suffer from this cause: a "spinners' phthisis" has been described by medical men, and it is attributed to the irritation produced by the dust and cotton inhaled: but it is admitted that the cases are scarcely, if at all, more numerous than in other employments.

The temperature of the mills varies from 60° to 75° Fahr.—the fine spinning mills only being of the latter temperature. The ventilation is good in some mills, and defective in others. The workmen are no where crowded together; nor can they be, from the space occupied by the machines; the air, therefore, is not vitiated from being frequently breathed.

As the unhealthiness of factory labour has been so often and so strongly alleged, and as the point is one of great importance, I shall state some of the evidence on both sides. And, first, as to the common prejudice that the steam-engine causes an incessant and unnatural

strain on the powers of those who work in conjunction with it; no opinion has been more strongly expressed, or perhaps more generally believed, except among manufacturers themselves, yet none appears to me more utterly destitute of foundation. There is the semblance of truth in such passages as the following, written by able men, who, no doubt, fully believed what they wrote:—

"While the engine works, the people must work. Men, women, and children are thus yokefellows with iron and steam; the animal machine — fragile at best, subject to a thousand sources of suffering, and doomed, by nature in its best state, to a short-lived existence, changing every moment, and hastening to decay—is matched with an iron machine insensible to suffering and fatigue."*

"The operatives are engaged in an employment which absorbs their attention, and unremittingly employs their physical energies. They are drudges who watch the movements, and assist the operations, of a mighty material force, which toils with an energy ever unconscious of fatigue. The persevering labour of the operative must rival the mathematical precision, the incessant motion, and the exhaustless power of the machine."†

These passages will be appreciated rightly after reading the following just and unanswerable remarks of a close observer of factory labour, Mr. Tufnell, one of the Factory Commissioners, who tells us, that "he was himself a short time ago impressed with the common prejudice respecting steam-engines, viz. that employment at them tended to degrade a man into a machine, and deaden all the powers of his mind." He says—

* The Effects of Arts, Trades, and Professions on Health and Longevity. By the late C. Turner Thackrah, Esq. Second Edition, p. 82.

† Dr. Kay on the Moral and Physical Condition of the Working Classes of Manchester, p. 24.

"Of all the common prejudices that exist with respect to factory labour, there is none more unfounded than that which ascribes to it excessive tedium and irksomeness above other occupations, owing to its being carried on in conjunction with 'the unceasing motion of the steam-engine.' In an establishment for spinning or weaving cotton, *all the hard work is performed by the steam-engine*, which leaves for the attendant no manual labour at all, and literally nothing to do in general, but at intervals to perform some delicate operation, such as joining the threads that break, taking the cops off the spindles, &c. And it is so far from being true that the work in a factory is incessant, because the motion of the steam-engine is incessant, that the fact is, that *the labour is not incessant on that very account*, because it is performed in conjunction with the steam-engine. Of all manufacturing employments, those are by far the most irksome and incessant, in which steam-engines are not employed; and the way to prevent an employment being incessant, is to introduce a steam-engine into it. And these remarks, strange as it may appear, apply peculiarly to the labour of children in cotton factories. Three-fourths of the children so employed are engaged in piecing at the mules, which, when they have receded a foot and a half or two feet from the frame, leave nothing to be done; *not even attention is required from spinner or piecer*, but both stand idle for a time, which, if the spinning is fine, lasts in general three-fourths of a minute, or more. Consequently, in these establishments, if a child remains during twelve hours a day, *for nine hours he performs no actual labour*.* A spinner told me, that during those intervals he had read through several books. The scavengers, who have been said to be 'constantly in a state of grief,' always in terror, and every moment they have to spare stretched all their length upon the floor in a state of perspiration,'† I have seen idle for four minutes at a time, and certainly could not find that they displayed any symptoms of the condition described in this extract from the Report of the Factory Committee."‡

* "A piecer, however, generally attends two mules, whose motion is alternate, and then his leisure is six hours instead of nine."

† See "Report of Factory Committee," p. 325.

‡ Report by Mr. Tufnell; Supplementary Report from the Factory Commissioners, part i. p. 205.

"In power-loom weaving the manual labour seems to be really nothing, as those who work at it frequently follow the motion of the lay, by leaning on it with their arms, with the view of taking exercise: it is also the healthiest of mill occupations."*

This is the true view of the matter. Instead of the workmen being "drudges," it is the steam-engine which is *their* drudge: and as to their motions "rivalling the mathematical precision, the incessant motion, and the exhaustless power of the machine," nothing can be more mistaken. It is the very reverse of the fact. All the precision, power, and incessant motion belong to the machines alone; and the work-people have merely to supply them with work, to oil their joints, adjust their slight inaccuracies, and piece the threads broken by the mechanical spinner.

I shall now quote the opinions of a skilful physiologist, the late Mr. Thackrah, of Leeds, whose work on "The Effects of Arts, Trades, and Professions, and of Civic States and Habits of Living, on Health and Longevity," displays acute observation and independent thought; but who looked with the eye of a medical man on all employments, and in almost all found some mischief; and who seems ever to have had in view, (as, perhaps, a medical man ought,) rather the training up of men to that high vigour which would fit them for the Grecian games, than their necessary subjection to the toils of trade and handicraft in an age of severe commercial competition. That gentleman was much more accustomed to the woollen and flax mills of Leeds than to the cotton mills of Manchester; but having attentively, though only for a

* Report by Mr. Tufnell; Supplementary Report from the Factory Commissioners, part 1 p. 206.

short time, observed the latter, he thus records his opinions :—

" COTTON WORKERS, persons, I mean, who are employed in the several processes by which the plant is formed into yarn for weaving, are subjected to considerable heat, and to some injurious agencies. I shall first refer to the process and operatives, as I found them in a large mill at Manchester, and one, I believe, of the best conducted. In the first process, the *machining*, or cleaning and opening the cotton, no increase of temperature is required; the labour is light; the operatives are not crowded, nor is there any defect in ventilation. Much dust is necessarily produced in the process, and light flakes of cotton float in the room; but the atmosphere is scarcely fouled, for a machine revolving 1200 times in a minute, produces a current of air, which, enclosed by a casing of wood, conveys the dust through a sort of chimney, quite out of the building. The children in this room made no complaint. The oldest man in it had been sixteen years at the employ. He was thin, but not sickly.

" In the *carding* and *preparing* room, the temperature is above 60°, a heat necessary to the working of the cotton and the machinery. The dust is not great; the labour is light, and the operatives are not crowded. The children, however, are puny. Head-ache and gastric disorders are frequent, especially among beginners. Common catarrh and coughs of short duration are found amongst the operatives, but not rheumatism or any urgent disease.

" In the *spinning* rooms, the temperature is 60° to 70°. Particles of cotton float like thistle down, but there is little dust. The machines are small, and the muscular exertion is good.

" In the *dressing* department, where the paste is applied to prepare the material for weaving, the heat of the room is greater than in any other process. We found it 98°, but were informed that it is generally rather higher. The men, however, appear healthy: some complained of 'aching of the bones,' but serious disease is rare, except as the result of intemperance. They do not experience inflammation of the lungs, pleurisy, or rheumatism. There are few examples, however, of men at the employ as old as 58.

" *Cotton weavers* in large mills we remarked to look better and be more healthy than the other operatives. At Manchester we saw

300 weavers, chiefly young women, at work in one room. This was, however, nearly three-fourths of an acre in area, well ventilated and lightsome. Scarcely any dust is produced by the weaving of cotton.

"In this mill 1500 persons are employed, and more than half of these are under the age of fifteen. It is said that none are admitted under that of nine, but several children, from their appearance, we should have supposed a year or two younger. There are few persons who have been more than thirty years in the cotton mills; and this circumstance is ascribed by the masters and overlookers to the better wages of other employments, and the consequent secession of operatives when they attain full age and strength. Most of the children are barefoot. The work commences at half past five A. M., and ends at seven P. M., and intervals are allowed of half an hour for breakfast, and one hour for dinner. The mechanics have half an hour also for afternoon meal; but this is not allowed to the children and other operatives. We were informed that at many mills no time is allowed for breakfast, though the work commences as early as half past five. At other mills, moreover, it appears that the dust is much greater, particularly in the carding rooms; and less attention is paid to the health and comfort of the operatives.

"I stood in Oxford Road, Manchester, and observed the stream of operatives as they left the mills at twelve o'clock. The children were almost universally ill-looking, small, sickly, barefoot, and ill-clad. Many *appeared* to be no older than seven. The men, generally from sixteen to twenty-four, and none aged, were almost as pallid and thin as the children. The women were the most respectable in appearance, but I saw no fresh or fine-looking individuals among them. And in reference to all classes, I was struck with the marked contrast between this and the turn-out from a manufactory of cloth. Here was nothing like the stout fullers, the hale slubbers, the dirty but merry rosy-faced piecer'ers. Here I saw, or thought I saw, a degenerate race,—human beings stunted, enfeebled, and depraved,—men and women that were not to be aged,—children that were never to be healthy adults. It was a mournful spectacle. On conversing afterwards with a mill-owner, he urged the bad habits of the Manchester poor, and the wretchedness of their habitations, as a greater cause of debility and ill health

than confinement in factories; and from him, as well as from other sources of information, it appears that the labouring classes in that place are more dissipated, worse fed, housed, and clothed, than those of the Yorkshire towns. Still, however, I feel convinced that, independently of moral and domestic vices, the long confinement in mills, the want of rest, the shameful reduction of the intervals for meals, and especially the premature working of children, greatly reduce health and vigour, and account for the wretched appearance of the operatives."

"We had no reason to believe that in the cotton mills urgent diseases are often produced, or the immediate mortality great. Disorders of the nervous and digestive systems are frequent, but not severe. Bronchitis and some pulmonary maladies are occasionally formed amongst the adult operatives, but neither prominent in feature, as far as we have observed, nor generally prevalent. Dr. Kay, however, whose residence at Manchester, and charge at the Ardwick dispensary, afford him more ample and continued opportunities of observing these operatives, describes a 'spinners' phthisis,' inflammation of the bronchial membrane terminating in consumption. He found it to occur chiefly where coarse cotton was manufactured, or comparatively little attention paid to ventilation, and protection of the operatives from dust. To me the principal physical effect of the heat and confinement appears to be exhaustion of the nervous system—that reduction of the vital power, which both renders the animal machine particularly susceptible of disorder, and prevents its lasting to its natural duration." (p. 144—148.)

Dr. Kay, who made extensive inquiries into the condition of the working classes generally, and especially of those inhabiting the worst parts of Manchester, at the time when the cholera was expected to visit that town, observes—

"The wages obtained by the operatives in the various branches of the cotton manufacture are, in general, such, as with the exercise of that economy without which wealth itself is wasted would be sufficient to provide them with all the decent comforts of life—the

average wages of all persons employed (young and old) being from nine to twelve shillings per week."* But he adds, "The population is crowded into one dense mass, in cottages separated by narrow, unpaved, and almost pestilential streets; in an atmosphere loaded with the smoke and exhalations of a large manufacturing city. The operatives are congregated in rooms and workshops during twelve hours in the day, in an enervating, heated atmosphere, which is frequently loaded with dust or filaments of cotton, or impure from constant respiration, or from other causes. They are engaged in an employment which absorbs their attention, and unremittingly employs their physical energies. They are drudges who watch the movements, and assist the operations of a mighty material force, which toils with an energy ever unconscious of fatigue. The persevering labour of the operative must rival the mathematical precision, the incessant motion, and the exhaustless power of the machine. Hence, besides the negative results—the abstraction of moral and intellectual stimuli—the absence of variety—banishment from the grateful air and the cheering influences of light, the physical energies are impaired by toil and imperfect nutrition. The artisan too seldom possesses sufficient moral dignity, or intellectual or organic strength, to resist the seductions of appetite. His wife and children, subjected to the same process, have little power to cheer his remaining moments of leisure. Domestic economy is neglected, domestic comforts are too frequently unknown." "His house is ill furnished, uncleanly, often ill ventilated, perhaps damp; his food, from want of forethought and domestic economy, is meagre and innutritious; he generally becomes debilitated and hypochondriacal, and, unless supported by principle, falls the victim of dissipation." Yet Dr. Kay immediately adds—"In all these respects it is grateful to add, that those among the operatives of the mills, who are employed *in the process of spinning*, and especially of fine spinning, (who receive a high rate of wages, and who are elevated on account of their skill,) are more attentive to their domestic arrangements, have better furnished houses, are consequently more regular in their habits, and

* Dr. Kay on the Moral and Physical Condition of the Working Classes of Manchester, p. 13.

more observant of their duties, than those engaged in other branches of the manufacture."*

This author seems to be of opinion, that the rate of mortality is not high in Manchester, but he considers the working classes generally to be suffering under a state of physical depression. Yet he admits that great improvements are taking place—"Some years ago," he says, "the internal arrangements of mills, (now so much improved,) as regarded temperature, ventilation, cleanliness, and the proper separation of the sexes, &c., were such as to be extremely objectionable."†

Mr. Thackrah allows the labour of the mills to be light, and not unhealthful, except from being too long continued, and Dr. Kay states that it is well remunerated; the picture given by the former of the appearance of the operatives, and that given by the latter of their toil, seem to me highly coloured, as indeed has been abundantly proved of one part of Dr. Kay's description. I proceed to adduce opinions and conclusions of a very different nature, given by medical men, by the Factory Commissioners and Inspectors, and by the operatives themselves.

Dr. Mitchell, the actuary, of London, to whom the returns obtained by the Factory Commissioners were submitted, drew up tables of sickness from them, and compared them with the results of similar inquiries made amongst the workmen in the employment of the East India Company—a very favourable specimen of workmen,—amongst the workmen at the government dock

* Dr. Kay on the Condition of the Working Classes of Manchester, pp. 24-26.
† Ibid. p. 80.

yards, and the children at Christ's Hospital. After stating the results in a tabular form, he expresses the following opinion on the whole:—

"Taking all in all, from the documents brought before me, *I have seen no grounds for warranting me in believing that factory labour in any material degree differs in its effects on health from other labour*; and at all events, the results ascertained from this long and laborious investigation appear to me to afford unanswerable evidence that the laudatory and condemnatory exaggerations of both parties are alike unfounded in truth."*

I extract from Dr. Mitchell's report the tables shewing the sickness in the cotton factories of Lancashire and Glasgow, and, for the purpose of comparison, those shewing the sickness in the woollen factories of the north of England, and among the workmen in the employ of the East India Company:—

* Supplem. Report of Factory Commissioners, part i. p. 61.

Sickness in the Cotton Factories, Lancashire.

AGE	MALES. Average Duration of Sickness per Annum for every Person employed	MALES. Average Duration of Sickness per Annum for every Person sick	FEMALES. Average Duration of Sickness per Annum for every Person employed	FEMALES. Average Duration of Sickness per Annum for every Person sick
	Days and Decimal Parts	*Days and Decimal Parts*	*Days and Decimal Parts.*	*Days and Decimal Parts.*
Under 11	2.46	13.04	8.03	——
From 11 to 16	3.81	14 58	4.25	11.98
—— 16 to 21	4.42	16.43	5.56	12.63
—— 21 to 26	4.91	18.27	6.85	16.42
—— 26 to 31	6.88	22 14	8.62	18.51
—— 31 to 36	3.85	12.19	9.29	21.77
—— 36 to 41	4.13	13.75	6.16	19.19
—— 41 to 46	5.09	14 25	14.67	14.41
—— 46 to 51	7.18	30.31	20.34	26.43
—— 51 to 56	3.47	13.10	15.75	21.00
—— 56 to 61	12.68	11.5	15.75	21.00
Sickness in Cotton Factories, Glasgow, &c.				
Under 11	1.01	3.61	2.63	14.90
From 11 to 16	4.80	12.35	6.18	13.81
—— 16 to 21	5.52	17.14	6 38	15 54
—— 21 to 26	9.11	20.12	8 16	18.96
—— 26 to 31	7.05	16.05	7.38	19.81
—— 31 to 36	7.65	16.93	6.05	13.05
—— 36 to 41	8.50	22.58	4.16	16.00
—— 41 to 46	5.12	16.41	11.94	20.36
—— 46 to 51	4.84	20.57	11.72	40.60
—— 51 to 56	4.90	16.41	16.50	25.85
—— 56 to 61	3.27	8·84	15.0	30.2
Sickness in the Wool Factories, North of England.				
Under 11	2.01	11.75	8 90	35.32
From 11 to 16	3.59	11.04	6.40	14.84
—— 16 to 21	5.31	17.14	6.98	19 96
—— 21 to 26	7.42	19.97	13.70	29 34
—— 26 to 31	0.33	25.25	13.54	30.53
—— 31 to 36	7.91	21.85	22.52	50.85
—— 36 to 41	5.43	15.37	15.21	24.75
—— 41 to 46	10 56	23.88	8.42	26.90
—— 46 to 51	12.90	35.46	19.16	40.83
—— 51 to 56	7.49	21.76	12.	22 00
—— 56 to 61	5.19	41.8	126.00	126.00

SICKNESS OF THE LABOURERS IN THE SERVICE OF THE EAST INDIA COMPANY.

AGE.	Average duration of sickness per annum for every man employed	Average duration of sickness for every man sick.
	Days and decimal parts	*Days and decimal parts*
16 to 21	4 02	13·96
21 — 26	5·40	17·22
26 — 31	4·49	20·18
31 — 36	4·55	21·44
36 — 41	5·57	23·84
41 — 46	5·18	22·83
46 — 51	5·43	23·59
51 — 56	6·80	28 61
56 — 61	7·21	28·28
61 — 66	10 24	31·25
66 — 71	9·93	26·89
71 — 76	10·60	29·67
76 — 81	12·67	38·88

Dr. Bissett Hawkins, one of the medical gentlemen on the Factory Commission, circulated a series of questions among the most experienced medical men in Manchester, Preston, Derby, and Knutsford;* and the answers to these questions are given in his report.† To the question—

* The medical men who replied to the queries were—(in *Manchester*) S. A. Bardsley, M.D., James L. Bardsley, M.D. Physician to the Infirmary, &c., John Alexander, M.D. of the Dispensary for Children, John Mitchell, M.D., Mr. Thomas Fawdington, Mr. W. R. Whatton, Mr. Robert Mann, C. Phillips, M.D., Charles Henry, M.D., George Shaw, M.D. Physician to the Salford Dispensary, Edward Carbutt, M.D. Physician to the Infirmary, J. D. Hulme, M.D., Edward Lyon, M. D. Mr. Roberton, Thomas Jarrold, M. D. and Mr. J. Boutflower, jun. (in *Preston*,) Mr. James Harrison, Mr. Brown, and Mr. Moore; (in *Derby*) R. F. Forester, M. D., Mr. Douglas Fox, Dr. Baker, Mr. Hill, Mr. Evans, Mr. Charles Borough, and Dr. Bent; (in *Knutsford*) Mr Peter Holland.

† Supplementary Report, part i. p. 229—254.

"*Have you observed that the persons employed in factories usually attain old age?*" The majority of the medical men reply *in the affirmative:* some state that the factory operatives are not shorter lived than others, but that they are not fit for that labour as they grow old, and turn to other employments, such as keeping a shop: some state that old men are seldom found in factories: but Dr. Carbutt satisfactorily accounts for this, by remarking that the average age of the cotton factories themselves does not exceed twenty years, and therefore it is very unlikely that any considerable proportion of the operatives who work in them should be old.

"*Is the mortality amongst factory children greater than in other classes?*" To this question, nineteen of the medical witnesses reply *in the negative;* two speak with hesitation, but fear the mortality is greater; one only answers distinctly in the affirmative: five can give no opinion. Several of the witnesses consider the mortality among the factory to be less than among other children. Dr. Shaw says—"I think I might go further, and say that the mortality amongst factory children is less than amongst other working classes. Factory labour is better remunerated than any other kind of labour, consequently the children generally are better fed and lodged; they are less exposed to the vicissitudes of climate; greater attention is paid to their comfort, at least in the silk and cotton factories of Manchester, many of which I have frequently inspected." Mr. Holland, who has for forty years professionally attended the apprenticed children at Messrs. Greg's factory at Styall, in Cheshire, says, that in the last twenty-two years, with an average of 90 children, there have been only 17 deaths, of which three died from

accidental causes wholly unconnected with their work; thus reducing the deaths to 14, or about one in 140, which could by any possibility be attributed to causes connected with factory labour. Nothing can be more satisfactory than the replies to the above question.

"*Are the wives of factory artisans equally prolific as those of other classes?*" Sixteen witnesses answer affirmatively; only two incline to a different opinion.

"*What proportion do miscarriages, still births, and fatal cases of pregnancy among the classes engaged in factory labour bear to those occurring in other situations?*" Only six witnesses offer an opinion on this point, of whom five (including a surgeon of the Manchester Lying-in Charity,) state that the labours of factory women are equally safe with those of other women.

"*Are there are any diseases or accidents to which factory children are particularly subject?*" Eight witnesses reply in the negative, as to diseases: most of them state that the children are liable to accidents from machinery, though not severe, and much less frequent now than formerly, owing to the general casing of the machinery. Several are of opinion, that the children are subject to swelled ankles, from long standing, and in some instances to distortion of the knee-joint; and that a scrofulous or consumptive tendency is increased by this occupation.

"*Have you remarked that the factory classes are more or less addicted to the use of spirits than other persons of similar means?*" Nineteen witnesses reply that the factory classes are *not* more addicted to the use of spirits than others; two, the contrary. Some add the remark, that intemperance is the great bane of

the working classes, but that factory labourers, from the regularity with which they must be at their work, are less frequently in the public-houses and dram-shops than other classes.

"*Are the children of factory operatives inferior in stature to those of your other classes, and to those of the inhabitants of the rural districts in your neighbourhood?*" The general tenor of the replies to this question is, that the children are less robust, and of somewhat lower stature, than children brought up in rural districts, but not inferior to those living in towns and differently employed.

"*Has the factory life any tendency to check the complete growth in those of either sex who have reached the age of puberty?*" Ten reply that it has; six, that it has not. Mr. Brown says, "As examiner to the recruiting service in this town, I have had abundant opportunities for observation; numbers of factory operatives, from the age of 18 to 24, have presented themselves for examination; but I cannot undertake to say that I have been able to discover any perceptible difference of stature legitimately attributable to the previous employment in which the recruit had been engaged."

"*Have you met with many instances in which adults employed in factories have been compelled to quit their employment through diseases apparently induced by their occupation?*" Thirteen reply substantially in the negative; nine in the affirmative.

"*Are the factory operatives more or less attentive to cleanliness and ventilation in their dwellings than other persons of similar means?*" Eighteen of the medical men answer that they are equally or more attentive to

cleanliness than other operatives; four, that they are less so. Dr. Charles Henry, of Manchester, remarks—"There is decidedly more comfort and cleanliness among those who work in factories, than among that class who work in their own dwellings. I regard the factory operatives, as a body, as decidedly superior in their command of the comforts of life, and even of luxuries, to any part of our population." Dr. Jarrold, on the other hand, says—"Women bred in factories can have no domestic habits, and are consequently inattentive to cleanliness. They make wretched wives. The door is commonly open in all classes, but seldom the window."

The sum of all this medical evidence is decidedly favourable, and it completely negatives the absurd imputations which have been cast on factory labour. It may be added, that Mr. Tufnell, in his report, gives strong reasons for thinking that factory labour is not unhealthy, that very few instances of deformity are now found in mills, and that the cases which do occur are attributable to the fault of the children or young persons, in stopping the throstle with their knee, instead of stopping it with their hands. Formerly, distortion of the limbs was more frequent, owing to the lowness of the old water-frames, which obliged the children to stoop.*

The testimony of the operatives themselves in regard to their health is not unimportant. The following tables were presented to the Factory Commission, as containing the results of an inquiry made by a committee of the master spinners, into the state of the work-people in the principal mills in Manchester where fine yarn is spun. A series of questions was sent to each mill, and the operative spinners furnished the answers, which were

* Supplementary Report, part i. p. 200.

then collated, and the results drawn out by a gentleman not engaged in the manufacture, John Shuttleworth, Esq. Distributor of Stamps, who swore to the accuracy of his deductions. The information it contains is important and interesting:—

MANCHESTER FINE MILLS, WORKING SIXTY-NINE HOURS PER WEEK. (19 MILLS.)

GENERAL STATEMENT of the Age, Time of Employment, and Health of Spinners, and their Opinions respecting the Effect of Factory Labour on Health, with Averages and Proportions deduced therefrom.

Number of Spinners	[illegible]	Years worked in Mill	Number absent from sickness in 1832	Days of sickness	Good health	Pretty Good	Indifferent	Number of Piecers	Piecers related to Spinners	Reports that health is injured	Reports that it is not injured	Number that cannot say whether health injured or not
837	27,367	19,133	255	6,29[illegible]½	621	171	45	3,233	488	180	558	99

Average ages of spinners 32^{7} years
Average number of years they have worked in mills . . . . 22⅞ do
Proportion of spinners absent sick in 1832 . 30½ per cent
Average duration of each case of sickness . 24¾ days
Proportion of sickness to total number of spinners . . . . . 7½ days.
Proportion of spinners who report they have good health . . . . 74 per cent
Do. do. pretty good 20½ do.
Do. do. indifferent 5½ do
Number of piecers to each spinner . . . 3.85
Proportion of piecers who are relatives of spinners for whom they work . . . . 15 per cent

Opinions of Spinners as to the Health of their Piecers.

Proportion who think health is injured by the present duration of factory labour . . . 21½ per cent.
Proportion who think health is not injured . 66½ do.
Proportion who have no opinion . 12 do

General Statement of the Ages and Marriage of Spinners' Wives, their Health, the number of Children born, the numbers alive and dead of different Classes of Children, and the number Distorted and Mutilated, with Averages and Proportions deduced therefrom

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Alive	[illegible]	Never worked: Alive	Never worked: Dead	Worked in Mills: Alive	Worked in Mills: Dead	Worked in other employment: Alive	Worked in other employment: Dead	[illegible]
407	1 576	651	11	1	10	10[illegible]	1 2[illegible]	1211	13[illegible]	1 [illegible]1	610	18	[illegible]	[illegible]	[illegible]	[illegible]

Proportion of spinners married 84 per cent
Do unmarried . 16 .
Average years of wives when married . 21[illegible]
Proportion of wives alive 96¾
Do. dead 3¼
Average years married 11¼
Proportion of wives whose husbands report them to have good health 72
Do pretty good . . 22¾ .
Do indifferent 5¼ .
Proportion of children to each married spinner 4½ children

Proportion of spinners' children alive 61 per cent
Do dead 39
Proportion of spinners' children who never worked in mills, alive 50
Do do dead 50
Proportion of do. who have worked in mills, alive 97¾
Do dead 2¼
Do. in other employments, alive 94
Do do dead 6
Proportion of spinners' children who are distorted 1 in 211
Do that have worked in mills, who have been mutilated by machinery 1 in 92

From these tables it appears, that 837 spinners had worked in mills not less than 22¾ years each on the average; that 71 per cent. of them stated themselves to have good health, 20½ per cent. pretty good health, and only 5½ per cent. indifferent health; that of their wives 95¾ per cent. were living, and only 3¼ per cent. dead; that the average number of years they had been married was 11¼, and their average number of children in that

time 1½. The number of children distorted was only one in 214.

The Factory Commissioners caused 1933 of the children, whom they saw in the Sunday schools of Manchester and Stockport, to be weighed and measured: an equal number were taken who were employed in factories, and who were not so employed, of different ages, from nine to seventeen; and the results were as follows:—

	lbs.	Inches.
Boys employed in factories	weighed 75.175;	measured 55.282
Boys not employed in factories	weighed 78.680;	measured 55.563
Girls employed in factories	weighed 74.739;	measured 54.951
Girls not employed in factories	weighed 75.049;	measured 54.979

This result shews a very slight difference to the disadvantage of the children employed in factories.

I may finally mention, that the four Factory Inspectors, whose reports to the Home Secretary have been printed by order of the House of Commons,[*] bear strong testimony to the healthfulness of factory labour, or at least negative the supposition that it is more unhealthful than other occupations. Mr. Leonard Horner, the Inspector for Scotland, the four northern counties of England, and the north of Ireland, says,

"It is gratifying to be able to state, that I have not had a single complaint laid before me; either on the part of the masters against their servants, or on the part of the servants against their masters; *nor have I seen or heard of any instance of ill-treatment of children, or of injury to their health by their employment.*" (p. 10.)

Mr. Rickards, who is the Inspector of the great manufacturing district of Lancashire, Yorkshire, Cheshire, part

* Reports of Inspectors of Factories, Parl. Papers, No. 596, sess. 1834.

of Derbyshire, and North Wales, encloses a most satisfactory letter from Mr. Harrison, surgeon, of Preston, who states that 1,656 children in the factories under his medical superintendence had good health, and that he had not met with a single instance of deformity referrible to factory labour. Mr. Rickards adds—

"The general tenor of *all* the medical reports in my possession confirms Mr. Harrison's view of the effects of factory labour on the health of the younger branches of working hands. *It is decidedly not injurious to health or longevity, compared with other employments.*" (p. 43.)

Mr. Saunders, the inspector of the eastern, southern, and part of the central and western counties of England, says—

"With some few exceptions, I have much satisfaction in stating, that I found the mills and factories remarkably clean, and apparently well regulated; and nothing came under my notice that would lead me to suppose that the operatives, whether adults, young persons, or children, were unhealthy, or so severely oppressed by labour, as has been strongly represented." (p. 62.)

This opinion is supported by that of Mr. Poyser, surgeon, of Wirksworth, who has the medical superintendence of the cotton mills of Messrs. Arkwright, of Cromford, and who says of the mill operatives, that "their general health is usually good," and that "the ratio of mortality is less in this class of people than in that of the poor who have no fixed employment, or whose occupation exposes them to the inclemency of the weather." (p. 68.)

I have entered at so great length into this subject, because of the extreme misrepresentations which have

been published upon it, and of the extensive effect which they produced,—an effect, which, if not counteracted by the establishment of the truth, would have caused multitudes to look with dissatisfaction, and even horror, on this great manufacture, and on the noble inventions which have raised it into a chief support of the national prosperity.

Abuses have undoubtedly existed in cotton mills, especially in employing children at too early an age, and for too long hours. The legislature has properly interfered to remedy this evil. In 1802, at the instance of the late Sir Robert Peel, a law was passed, prohibiting the employment of apprentices for more than twelve hours a day. In 1819, the same gentleman obtained an Act extending this prohibition to the labour of all children under sixteen years of age, and making it illegal to employ any children under nine years of age in cotton factories. This law was imperatively called for, to put an end to the cruel practice which then existed in many mills, and to which the owners had a strong temptation, of causing the children to work fourteen or sixteen hours a day. Young children are proper objects of legislative protection, not being themselves free agents, but under the joint control of their parents and their masters; the former of whom, though their natural guardians, often allowed them to be over-worked for the sake of the higher wages they earned. In 1831, Sir John Hobhouse brought in a bill in the House of Commons, to shorten the term of labour for young persons under eighteen years of age in all factories to 11½ hours a day, but in this object he was defeated: his bill passed, but it left the term of labour twelve hours, and was confined in its operation to the cotton mills. In 1832, Mr. Sadler attempted to

reduce the hours to ten per day, and Lord Ashley renewed the attempt in 1833, but without success. Lord Althorp, the Chancellor of the Exchequer, justly considering the subject of great importance, and also of much difficulty, supported a motion by Mr. John Wilson Patten, appointing the Commission which has been several times referred to, for the purpose of collecting information in the manufacturing districts themselves relative to the condition of the factory children.

On the recommendation of the Commissioners a bill was drawn up, which ultimately passed into a law, (3 and 4 Will. IV. c. 103,) and of which the following is the substance:—

1. That after the 1st of January, 1834, no person under 18 years of age shall be allowed to work in the night, that is, between half-past eight, p. m. and half-past five, a. m., in any cotton or other factory, in which steam or water, or any other mechanical power, is or shall be used to propel the machinery, excepting in lace factories.

2. That no person under 18 shall be employed more than 12 hours in one day, nor more than 69 in one week.

3. That there shall be allowed, in the course of every day, not less than $1\frac{1}{2}$ hour for meals to every person restricted to the performance of twelve hours' work.

4. That after the 1st of January, 1834, no child, except in silk mills, shall be employed, who shall not be nine years old.

5. That after the 1st of March, 1834, no child, except in silk mills, shall be employed in any factory more than 48 hours in any one week, nor more than nine hours in any day, who shall not be 11 years old; nor after the 1st of March, 1835, who shall not be 12 years old; nor after the 1st of March, 1836, who shall not be 13 years old: and that these hours of work shall not be exceeded even if the child has worked during the day in more factories than one.

6. That children and young persons whose hours of work are regulated shall be entitled to two holidays and eight half-holidays in every year.

7. That children whose hours of work are restricted to nine hours a day, are not to be employed without obtaining a certificate from a physician or surgeon, certifying that they are of the ordinary strength and appearance of children of the age before mentioned, which certificate is to be countersigned by some inspector or justice.

8. That it shall be lawful for his Majesty to appoint during pleasure, four persons to be inspectors of factories, with extensive powers as magistrates, to examine the children employed in the factories, and to inquire respecting

their condition, employment, and education; and that one of the secretaries of state shall have power, on the application of an inspector, to appoint superintendents to superintend the execution of the Act.

9. That those inspectors are to make all rules necessary for the execution of the Act, and to enforce the attendance at school, for at least two hours daily, out of six days in the week, of children employed in factories, from whose weekly wages a deduction not exceeding 1d. in every shilling for schooling, shall be made.

10. That no child shall be employed who shall not, on Monday of every week, give the factory master a certificate of his or her attendance at school for the previous week.

11. That the interior walls of every mill shall be whitewashed every year.

12. That a copy or abstract of the Act shall be hung up in a conspicuous part of every mill.

13. That the inspectors shall regularly, once a year, report their proceedings to one of the secretaries of state.

The Act also contains regulations extending the hours of work where time shall be lost by the want of, or an excess of, water in mills situated upon a stream of water; respecting the steps to be taken in order to obtain regular certificates of age for the children requiring them; respecting the erection of schools where necessary; and respecting the proceedings to be had before inspectors and magistrates, for enforcing the Act, and the right to appeal from their decisions.

Some of the provisions of this Act have proved to be quite impracticable. All the Inspectors declare, that the clauses requiring the education of the younger children, and forbidding those children to be worked more than 18 hours in the week, that is, eight hours in the day, have only had the effect of compelling the masters to discharge the children between nine and eleven years of age. If the Act should continue in force, all children under twelve years of age would be discharged in March, 1835, and this would make it impossible in many cases to carry on the mills, as children above that age could not be had in sufficient numbers. The Inspectors, therefore, state, that the Act must be amended in these respects; and there can be no doubt that this amendment will take place next session. It is found impossible to compel the education of the children, and the attempt to do it has only produced hardship to them

and their parents, from the number who have lost their employment. The commissioners had hoped that the manufacturers might obtain relays of children, each set working not more than eight hours a day, whilst those above 13 years of age worked twelve hours. But neither can the children be obtained, nor will the masters submit to the inconvenience caused by the change of hands. Mr. Rickards, Mr. Saunders, and Mr. Howell, the Inspectors, are of opinion that children of ten years of age may be properly allowed to work twelve hours a day; but Mr. Horner would fix eleven as the age under which children should not be allowed to work those hours.

Feeling most sensibly the importance of education to the working classes, and the undesirableness of working children at a tender age, I am yet convinced that very many of the poor have not the means either of educating their children, or of supporting them in idleness; and that, therefore, to forbid the admission of such children into mills is, in fact, to consign them to the streets, and to deprive them of that food which their work might procure. By fixing the limitation too low, great hardship is inflicted on the working classes: it is an ill-judging humanity, which defeats its own end. Moreover, all restrictions on industry should be imposed with a delicate and cautious hand. England has manufacturing rivals;* and if parliament were, from a false

* To show the danger of too great an interference with industry, it may be stated that the French cotton mills work *fourteen and a half* or *fifteen* hours a day, according to M. Mimerel, the cotton spinner, who was delegated by the chamber of commerce of Lille, Roubaix, and Turcoing, to give evidence before the Commission of Inquiry instituted by the French government, (in November, 1831.) Children of eight, and even of six years old, work these hours. Mr. Bannatyne informs us, that in Switzerland the working hours at the cotton mills are *fourteen* hours a day, and in the Rhenish provinces of Prussia they are *fifteen* or *sixteen*.

humanity, to limit the persevering industry of our workmen, one of our principal advantages over other nations would be sacrificed, and the labourers themselves would be the greatest sufferers. It may be justifiable to forbid children below ten years of age working 12 hours a day: but when the extreme lightness of the work, the necessities of the working classes, and the prosperity of the trade by which they live, are considered, it appears to me undesirable and dangerous to fix any higher limit.

It has been alleged that great immorality prevails among factory operatives, owing to young persons of both sexes being thrown so much together. The morality or immorality of the operatives must be affected by the character of the masters and overlookers, and by their negligence or care in watching the conduct of those under them. It is to be feared that licentiousness prevails in some mills, yet this is certainly very far from general. Mr. Tufnell made particular inquiries on this point, and he declares that "the whole current of testimony goes to prove that the charges made against cotton factories, on the ground of immorality, are calumnies."* He examined several clergymen and ministers of religion, who concurred in representing the morals of factory operatives to be quite as good as those of other work-people. Great numbers of the factory workers attend Sunday-schools, either as teachers or learners.† Several of the female teachers in the Stockport Sunday-school, who work in factories, and whose own characters are above all suspicion, stated that the factory females in general were quite as moral as those

* Supplementary Report of Factory Commissioners, part i. p. 201.

† Mr. Holland Hoole, in a "Letter to Lord Althorp, in Defence of Cotton Factories," states, that in his mill there are 768 persons of all ages, of whom "298 attend Sunday-schools, without any influence or inducement on the part of their employers, and 11 of them are teachers in these schools."—p. 8.

in other occupations. From a return given by Mr. Tufnell, it would appear that four times as many illegitimate children are born among the females who do not attend factories in Stockport, as among those who do, in proportion to their numbers. It may be feared that this proportion would not generally hold. There cannot be a doubt that the master is to blame, where any great immorality prevails in a mill.

It were earnestly to be wished that master manufacturers were generally alive to the great influence which they possess, and to the responsibility which consequently rests upon them. On their regulations, much of the health, the morals, and the comfort of their work-people depends. If a medical man were engaged to pay a weekly visit to every mill, which would be a trivial expense, it would be impossible for any child to grow deformed, or for a person of any age to work himself into disease, because the evil would be checked in its origin. If immorality were punished by dismission, as it might be with great propriety, a most powerful check to vice would be established. If the children were encouraged to attend Sunday schools, they would generally attend them.

The factory system is not to be judged as though it were insusceptible of improvement. Much has been done to improve it of late years. More may still be done. There are not a few mills in Lancashire, Yorkshire, Cheshire, Derbyshire, and Scotland, where ventilation, cleanliness, and even neatness, are enforced, greatly to the advantage both of the master and of the workmen; where strict regulations exist against immorality of conduct or language; where schools are taught, in which every child employed in the manufactory receives instruction, and where the girls

learn sewing and knitting; where there are libraries for the use of the work-people, and rewards for the children who attend Sunday schools; where there are benefit societies, which afford relief to the subscribers in sickness or in misfortune; and where medical men are employed to inspect the workpeople weekly. No man can reflect on the matter without perceiving, that a humane, religious, and intelligent manufacturer has the power of bringing to bear on his workpeople a variety of strong inducements to virtue and industry;—that by an apparatus of means like those above mentioned, by the appointment of steady overlookers, and by his own vigilant superintendence, much, very much, might be done to make a factory rather a school of virtue than of vice. If it be contended, that a mere sordid cupidity actuates the manufacturers, and that they will never be induced to take these measures for the improvement of their operatives; I reply, that the mill-owners are neither more under the influence of avarice, nor less under the influence of better motives, than any other class of men. On the contrary, many of them are men of enlarged minds and humane feelings; most of them have the means of instituting these improvements, which would require but a trifling expenditure; and nearly all, from their very habits of business, are accustomed to those extended views and calculations, which enable them to look forward with confidence to a distant advantage from an immediate outlay. Some from benevolence, some from emulation, some from shame, and more, perhaps, than all from a conviction that it would actually tend to profit, may follow the examples already set; and in ten or twenty years hence, the factories of England may be as much improved in the moral

character of their operatives, as they have been in times past in the beauty and efficiency of their machinery. That it is the imperative duty of masters to use all the means they possess of benefiting and improving those who are under their control, no man of correct principles can doubt; and I believe the conviction is strengthening and spreading, that it is eminently the *interest* of a manufacturer to have a moral, sober, well-informed, healthy, and comfortable body of workmen.

It would be impossible to enter into a particular investigation of the numerous kinds of labour requisite to the completion of the manufacture, as to their rate of remuneration, their healthfulness, and the physical and moral condition of the workmen. It has already been remarked, that the calico printers, bleachers, dyers, engravers, calenderers, and various classes of mechanics, earn excellent wages, and, of course, have a great command of the necessaries and comforts of life. As a general remark, it may be said that their wages are proportioned to the skill, care, and exertion required from them. Their state of health and morals does not differ from those of other classes of artisans and labourers whose employments resemble theirs.

The *hand-loom weavers*, however, form so numerous a class, and are in a condition so different from all other labourers employed on cotton, that they call for a distinct notice. This is the only class whose implements of labour have undergone scarcely any improvement for the last seventy years, and it is the only class that has sunk into distress and degradation. A new mode of weaving has indeed been invented, but this class adheres to the old. It has been seen that the power-loom weavers are in circumstances of great comfort, but the hand-

loom weavers earn miserably low wages, and are in a state perhaps below that of any other class of labourers in the country. There is, however, a distinction to be made among the hand-loom weavers, according to the kind of goods on which they are employed. Those employed in weaving fancy articles, which require skill and care, and in weaving quiltings, which require strength as well as care, obtain much better wages than the weavers of plain goods, which require very little strength or skill. It is only the latter whose state is so utterly deplorable.

"The hand-loom weavers," says Dr. Kay, speaking of those living in Manchester, "labour fourteen hours and upwards daily, and earn only from five to seven or eight shillings per week. They consist chiefly of Irish, and are affected by all the causes of moral and physical depression which we have enumerated. Ill-fed, ill-clothed, half-sheltered, and ignorant—weaving in close, damp cellars, or crowded, ill-ventilated workshops—it only remains that they should become, as is too frequently the case, demoralized and reckless, to render perfect the portraiture of savage life." The statement that the weavers work fourteen or sixteen hours per day has been so often made, that it is now generally believed. The fact, however, is, that they work these long hours only two or three days in the week, and they generally, notwithstanding their poverty, spend one or two days in idleness; their week's labour seldom exceeds fifty-six or fifty-eight hours,* whilst that of the spinners is sixty-nine hours. This irregularity on the part of the weavers

* The weavers themselves admit that ten hours and a half a day is considered by them "hard work:" Richard Needham and William Pilling, weavers, of Bolton, stated this to the Committee on Manufactures, &c. (Report, p. 700.) The

is to be ascribed in some degree to the wearisome monotony of their labour, from which they seek refuge in company and amusement; and also to their degraded condition, which makes them reckless and improvident.

The weekly wages of several classes of hand-loom cotton weavers, in each year from 1810 to 1825, has been given in a table at p. 438; and their wages in 1832 are given in a table at p. 439. The former states the wages of the weavers of calicoes at the astonishingly low rate of 4s. 3d. in the year 1825; but these goods were chiefly woven by women and children. The latter table does not mention the prices paid for calicoes; but it shews that in 1832, the average wages for weaving common checks, common nankeens, and cambrics, all of which are woven principally by women and children, were from 6s. to 6s. 6d., 7s., and 8s.; the wages for fancy checks, woven by men, were 7s. to 7s. 6d.: and for fancy nankeens and quiltings, from 9s. to 12s., 13s., and even 15s. Mr. George Smith, of the firm of James Massey and Son, of Manchester, gave evidence before the Committee of the House of Commons on Manufactures, Commerce, &c., in July, 1833, that the weavers of calicoes in the neighbourhood of Burnley and Colne earned little more than 4s. per week net wages: these, however, were almost all children: of the whole number of hand-loom cotton weavers in the kingdom, which he estimated at 200,000, he supposed that 30,000 earned this low rate of wages; whilst the remaining 170,000 would only earn 6s. or 7s. a week: in the neighbour-

same account of the duration of their day's labour was given by Mr. Jeshua Milne, of Crompton, as on the authority of the weavers themselves. (p. 659.) Mr. James Grimshaw, of Barrowford, stated the working hours of the weavers to be sixty hours per week. (p. 600.)

hood of Manchester he thought the average would be 7s.* Mr. John Makin, a manufacturer, of Bolton, stated before the Committee of the Commons on Hand-loom Weavers, in July, 1834, that a weaver of the kind of cambric most commonly produced there, namely, a six-quarter 60-reed cambric, 120 shoots of weft in an inch, could only weave one piece in a week, the gross wages for which were 5s. 6d.—subject to a deduction of about 1s. 4d.† Hugh Mackenzie, a hand-loom weaver of Glasgow, informed the same Committee that the average net wages of the weavers of plain goods in that city and neighbourhood would scarcely amount to 5s. per week.‡ Mr. William Craig, a manufacturer of handkerchiefs and ginghams at Glasgow, stated the net wages of weavers in that department to be 4s. 6d. to 5s. a week;§ and Mr. Thomas Davidson, a manufacturer of fancy lappet goods in that city, stated the wages of the plain weavers to be from 5s. to 5s. 6d. net on the average, and that the plain weavers were two-thirds or three-fourths of all the hand-loom weavers in Scotland, whilst the remaining one-third or one-fourth earned on an average about 8s. a week.|| On the proceedings of the Committee on Hand-loom Weavers, it may be observed, that the selection of the witnesses, and the mode of examining them, shew some disposition to make out a case; and the most unfavourable view of the weavers' condition is presented.

The following statement, drawn up by Dr. Cleland for the Board of Trade, appears in the "Tables of Revenue," &c., for 1832, (part i. p. 107):—

* Report, pp. 562, 567. † Report, Q. 4498, 5006. ‡ Report, Q. 677
§ Ibid. Q. 1314. || Ibid. Q. 2102, 2121.

DAILY WAGES OF COTTON WEAVERS IN THE CITY OF GLASGOW, FROM 1810 TO 1819, AND IN 1831.

FABRICS WOVEN.	1810	1811	1812	1813	1814	1815	1816	1817	1818	1819	1831
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
4-4th Cambrics, 1,300*	2 7½	1 3	1 6	2 0	2 6	2 0	1 9	0 10½	1 3	0 9	1 0
6-4th Book Muslin, 1,400	2 7	1 8	1 11½	2 3½	2 11	2 6½	1 8	1 2½	1 8	1 2½	1 4
4-4th Jaconets, 1,200	1 0	1 6	1 6¼	1 7½	2 0½	1 8¼	0 10¾	0 9½	1 0	0 8¼	0 11
4-4th Pullicates, 1,300	2 0	1 0	1 8	2 2	2 4	1 8	1 1	1 0	1 0	0 10	1 1
4-4th Checks, blue and white, 1,000	1 7½	1 3	1 5	1 7½	1 7½	1 7½	0 9½	0 9½	1 1¼	0 8¼	0 11
5-4th	2 4½	1 10	2 0½	2 3	2 3	2 3	1 2½	1 2½	1 7½	1 0	1 2
11-8th Ginghams, 1,300	1 11	1 3	1 7½	2 0¼	2 2	1 11	0 11	0 11½	1 1	0 10	1 0

* "4-4th cambric is frequently wrought by boys or old men, who can make 7d. per day The prices quoted for weaving are what the weaver nets per day after deducting 3d. for loom-rent, reddles, brushes, dressing, coal, and candle; and it appears from an account taken from the books of different manufacturers, that steady weavers have netted these wages throughout the respective years, on an average of twelve working hours per day. Winding weavers' pirns.—This is generally done in the weaver's family: a woman can wind for three weavers, and she can make 3d. per day by each weaver."

The rapid declension in the wages of weaving is shown by the following tables, the first of which was given in to the Committee of the Hand-loom Weavers by Mr. Makin, of Bolton;* and to the Committee on Manufactures by Richard Needham, a weaver, of Bolton:—†

WAGES paid for WEAVING a Six-Quarter 60-Reed CAMBRIC, 120 picks in one inch, in BOLTON.

YEARS.	WAGES.		YEARS.	WAGES.		YEARS.	WAGES.		YEARS.	WAGES.	
	s.	d.		s.	d.		s.	d.		s.	d.
1795	33	3	1805	25	0	1815	14	0	1825	8	6
1796	33	3	1806	22	0	1816	12	0	1826	7	0
1797	29	0	1807	18	0	1817	9	0	1827	6	6
1798	30	0	1808	15	0	1818	9	0	1828	6	0
1799	25	0	1809	16	0	1819	9	6	1829	5	6
1800	25	0	1810	19	6	1820	9	0	1830	5	6
1801	25	0	1811	11	0	1821	8	6	1831	5	6
1802	29	0	1812	14	0	1822	8	6	1832	5	6
1803	24	0	1813	15	0	1823	8	6	1833	5	6
1804	24	0	1814	21	0	1824	8	6	1834	5	6‡

Another table of the wages paid for weaving an ordinary kind of calico, furnished by Mr. Geo. Smith, of Manchester, to the Committee on Manufactures, &c., from his father's books, shews the same rapid declension:§—

* Report, Q. 5032. † Report, p. 699.
‡ After making deductions for expenses, the clear wages of the weaver are only 4s. 1½d. per week.
§ Report, p. 561.

WAGES paid for WEAVING the 2d quality of 74's CALICO, in the Neighbourhood of BURNLEY and SKIPTON.

YEARS.		YEARS.	WAGES.	YEARS.	WAGES.	YEARS.	WAGES.
	s. d.		s. d.		s. d.		s. d.
1802	8 7	1810	6 2	1818	3 3	1826	1 3
1803	7 0	1811	3 9	1819	2 5	1827	1 5
1804	6 0	1812	4 7	1820	2 7	1828	1 8
1805	5 8	1813	5 7	1821	3 2	1829	1 1
1806	5 5	1814	5 10	1822	2 7	1830	1 5
1807	4 9	1815	4 1	1823	2 2¼	1831	1 7
1808	2 9	1816	2 10	1824	1 10	1832	1 3½
1809	2 6	1817	2 8	1825	2 2½	1833	1 4½

The witness added, that the cloth was two inches narrower now than in 1802, and that a loom will turn out more pieces now than it would then, as the yarn is now delivered out to the weaver sized, which was not the case formerly. This last observation applies to most other kinds of weaving. It must also be constantly borne in mind, that the wages paid during the war were in a depreciated currency, and that they are now paid in a currency of full value: this makes a considerable difference in the price of provisions, clothing, &c., of which a greater quantity may be obtained for the same money.

These tables naturally draw our attention to the occasions on which the great fall in the wages of weavers took place, and to the immediate causes of that fall. It may first be observed that the wages of weaving had previously risen even more rapidly than they

afterwards fell. Before the invention of the fly-shuttle and the spinning machines, the weavers' wages were very moderate; and when the greater difficulty of weaving without the fly-shuttle, and the greater strength required by the coarse goods then made, are considered, it may be doubted whether the weavers then earned higher wages in proportion to their labour than at present. The fly-shuttle, which enabled a weaver to turn out twice as many webs as before, was the first cause of a material improvement in wages. As the price of goods did not fall in proportion to the increased facility of production, the weaver gained considerably by the invention. Then came, in rapid succession, the grand inventions of the spinning jenny, the water-frame, and the mule, which caused the unparalleled extension of the manufacture we have already seen, and enabled the cotton weavers to produce a great variety of delicate fabrics before unknown to their looms. Calicoes, muslins, cambrics, nankeens, and many other tissues, began to be woven in England, and as they could be afforded much below the prices formerly paid for the Indian goods of those qualities, the demand for them was great and urgent; weavers were in the utmost request, and their wages rose to a rate exceeding those of any other class of workmen: common weavers, of steady and industrious habits, soon rose into manufacturers, and many fortunes were made at the loom. This induced multitudes to learn the trade, and it continued to attract hands long after the demand was satisfied. An employment so easily learnt, and so handsomely remunerated, became inevitably surcharged with labourers. Then came the reaction. Wages must have fallen even with an unvarying trade: but at every shock which the

manufacture received from external or internal circumstances, a great and sudden decline took place, which, from the constant pressure of a surplus body of labourers, could never be recovered. From 1795 to 1807, as will be seen by the above tables, wages gradually receded, notwithstanding a depreciating currency, except in the year 1802, when the peace of Amiens opened the markets of Europe for a short space to English commodities. The year 1808 was that of the American embargo, when an extremely small supply of cotton reached this country, and thousands of weavers were thrown out of employment. Hence the price of weaving calicoes fell from 4s. 9d. in 1807, to 2s. 9d. in 1808.* The revival of trade, the flush of paper money, and the famine price of corn, raised wages again; and they were sustained by the re-opening of the continental markets, and the quantities of English goods poured in upon them. In the year 1814, the national fever was at its height. Before 1816, all its debilitating consequences were felt. The foreign markets were glutted; the merchants received no returns; the exchanges fell; government issued no more orders to the manufacturers; the American war closed to us a large market, and

* In the year 1808, Mr. William Radcliffe, the joint inventor of the dressing machine, gave evidence before a Committee of the House of Commons, appointed to inquire into the claims of the Rev. Dr. Cartwright to a parliamentary grant for the invention of the power-loom; when he gave the following statement in writing:—"To that part of your question, whether I think the general adoption of the loom by power will operate to the prejudice of the weavers in the old way? I answer, No. In the first place, their situation for the last twelve or eighteen months has been such, that *it cannot be made worse*, as during this time, generally speaking, they have neither been able to pay rents or buy themselves clothes; *all their earnings have barely been sufficient* to keep them alive; and those who have families to support are obliged to work from 16 to 18 hours in the day to do this."—*Radcliffe's Origin of Power-Loom Weaving*, p. 50.

deprived us of the supply of cotton-wool; the Bank of England rapidly contracted its issues; the paper-bubble burst; banks and commercial men failed in fearful numbers; a wretched harvest plunged the farmers into alarm and distress; and many of the disbanded soldiers and sailors, turning to the loom as the easiest trade they could learn, came into competition with the weavers. Under the accumulated disasters of this crisis, the weavers received their severest blow. The wages of cambric weavers fell from 24s. in 1814 to 12s. in 1816, and those of calico weavers from 5s. 10d. in the former year to 2s. 10d. in the latter. Before they could in any degree recover, the power-loom rose into formidable competition with the hand-loom. The commercial crisis of 1825-6 was the final calamity. And thus, under reiterated strokes, the hand-loom weavers have been pressed down, and have never, till within the last two years, had even a glimpse of improvement. During that time their wages have risen about 10 or 15 per cent., but the weavers still remain the most depressed and degraded class of English labourers.

These were the occasions and direct causes of the lamentable fall in weavers' wages; but their effects could not have been so serious if there had not been permanent causes, belonging to the nature of the employment itself. Of these, the *first* and grand cause is, *the easy nature of the employment.* The weaving of calicoes is one of the simplest of manual operations, understood in a few moments, and completely learnt in a few weeks. It requires so little strength or skill, that a child eight or ten years of age may practise it.* A man brought

* Before the Committee on Manufactures, Commerce, &c. Mr. James Grimshaw, manufacturer, of Barrowford, near Colne, when asked—" What would be the age

up to any other employment may also very shortly learn to weave. From the facility of learning the trade, and from its being carried on under the weaver's own roof, he naturally teaches his children to weave as soon as they can tread the treadles, if he cannot obtain places for them in a factory. Thus they begin at a very early age to add to the earnings of the family, and the wife also toils in the same way to increase their scanty pittance. But it is obvious that that which is only a child's labour, can be remunerated only by a child's wages. There are large departments of hand-loom weaving which are almost entirely given up to women and children, and their wages go far to regulate all the rest. The men, where they are able, procure better kinds of work; and where they are not able, they must put up with the most paltry earnings.

The *second* cause for the low wages of weavers is, that their employment is in some respects *more agreeable, as laying them under less restraint than factory labour*. Being carried on in their own cottages, their time is at their own command: they may begin and leave off work at their pleasure: they are not bound punctually to obey the summons of the factory bell: if they are so disposed, they can quit their loom for the public-house, or to lounge in the street, or to accept some other job, and then, when urged by necessity, they

of the youngest person working in such a family?" replied, "I know there are plenty of weavers' children who begin to weave, as young as eight years, by weaving alongside the father, and the father comes to regulate it if any thing goes amiss." "Then it is within your knowledge that a child of eight years is actually employed in managing a loom? *A very common case.*"—*Report*, p. 601. Mr. Geo. Smith informed the same Committee that children began to weave at ten to twelve years old. p. 563.

may make up for lost time by a great exertion.* In short, they are more independent than factory operatives; they are their own masters; they receive their materials, and sometimes do not take back the web for several weeks; and—what is a lamentable, but far too common occurrence—they have the power, in case of urgent necessity or strong temptation, to embezzle a few cops of their employers' weft in order to buy bread or ale.† All this makes the weaver's occupation more seductive to men of idle, irregular, and dissipated habits, than other occupations. It is a dear-bought, miserable liberty, but, like poaching or smuggling, it is more congenial to some tastes than working under precise restrictions for twice the remuneration. The mention of this unquestionable fact by no means implies a charge against the weavers, that they are all of loose habits and morals; but it helps to account for many continuing at the loom, notwithstanding the wretchedness of their circumstances.

A *third* cause for the low wages of hand-loom weavers is, the *surplus of hands*, which there is now, or was for a long time, in the employment. This arises in part out of the two former causes. The families of the weavers themselves would keep up a full supply of workmen; but

* This cause is assigned by Mr. John Kingan, manufacturer, of Glasgow, in his evidence before the Committee on Hand-loom Weavers; Q. 165.

† This embezzlement is to a deplorable extent: Mr. Makin, of Bolton, assigned it as one considerable cause of the depression of wages: the embezzled yarn is bartered for drink at the public-house, or sold directly to disreputable persons, who manufacture goods from it, and undersell the respectable manufacturer. The latter is compelled to lower his wages, that he may not be driven out of the market, and thus the fraud of the weavers increases their own suffering.—*Report of Hand-loom Weavers' Committee* Q. 5030.

others, who are destitute, take up the occupation, especially the Irish, who have been compelled or tempted to come to Great Britain. Many of these have been linen weavers, who have lost their employment, from the use of linen having been in some degree superseded by calico shirting and sheeting woven by the power-loom.* Large colonies of Irish are settled in Manchester, Glasgow, and other manufacturing towns. Accustomed to a wretched mode of living in their own country, they are contented with wages which would starve an English labourer; unless indeed it have the effect, as seems too probable, of dragging many of the English down to their own level.

On this third cause, however, it is necessary to explain and qualify. The fact of a present redundancy of labour at the hand-loom, though generally believed, is by no means certain. The evidence before the two committees of the House of Commons, on Manufactures, &c. in 1833, and on Hand-loom Weavers in 1834, fully proves that neither in Lancashire nor in Scotland is there any number of weavers unemployed. Hugh Mackenzie, in answer to the question—"Is there sufficient employment in the muslin line?" replied—"In the city of Glasgow there lately was an apparent shade of dulness; but there is not a hand going idle that I know of."† Mr. Makin, of Bolton, said, "Their wages are lower than ever I have known them at any former period; their employment is complete; I do not suppose that there is or needs to be one weaver out of employment, and

* Evidence of Mr. W. Craig, of Glasgow, before the Committee on Hand-loom Weavers; Q. 1354, 1358.

† Report on Hand-loom Weavers; Q. 665.

that has been the case for the last three or four years."* The same manufacturer also said—"With reference to the hand-loom, I cannot state that there is such an increase of production; in the power-loom it has greatly increased; but I do not suppose that there are many more hand-looms in employment than there were seven years ago; I do not know a weaver's joiner who has made a new pair of looms this seven years: there is a species of hand-loom called the dandy, which is a sort of medium between the power and the hand-loom, and in that particular branch there has been a large increase."† Mr. George Smith stated that, "the hand-loom weavers (near Burnley) were in full employment."‡ Mr. Milne said the same thing of the weavers at Crompton.§ Combining these strong assertions with the fact that the wages of hand-loom weavers have improved 10 or 15 per cent. within the last two years, it seems to be clear that there cannot now be a surplus of hands in this line; and a glimpse of hope is afforded that the weavers have seen the worst, that necessity has driven some of them to other employments, that the other branches of the manufacture have been able to absorb them, and that at least the victims of so much misery are not increasing in numbers. This is the first

* Report on Hand-loom Weavers; Q. 1972.

† Report, Q. 5037. Mr. Makin explains that the dandy-loom is "about the same dimensions as a power-loom, constructed of wood or iron as may be, to which there is machinery adapted to move the cloth onwards as it is woven, and thereby prevent the necessity of the weaver stopping to draw the yarn forward to be woven." Q. 5038. Mr. Makin adds, that good wages may be made by a dandy-loom weaver, but that the labour is severe and over-exciting. Q. 5044.

‡ Report of Committee on Manufactures, &c. p. 567.

§ Ibid, p. 658.

shade of improvement in their condition for nearly twenty years. During that long period their numbers have seemed to be redundant, but the causes of that redundancy may have been met and counterbalanced by still stronger causes, namely, the wretchedness of the weaver's lot, which has driven him to other employments, and the ever-increasing demand for cotton goods, which keeps power-looms, dandy-looms, and hand-looms all in request. It is still, however, to be feared that there is a tendency to a superfluous number of weavers, in the circumstances before mentioned, and that, on the next check given to the trade, this will be made manifest. There can be no reasonable hope that the weavers will ever again earn satisfactory wages.

This is forbidden by the fourth cause of their depression, namely, the *power-loom.* The invention of mechanical weaving has been generally alleged as the principal cause of the distress of the hand-loom weavers; but causes have been assigned much more efficient, and which produced a great part of the effect before the power-loom came into use. It has been seen that the wages of the hand-loom weavers fell much more before 1818 than they have done since, yet in the latter year there were only 2000 power-looms in Lancashire. The manufacturers themselves who employ hand-loom weavers, are of opinion that machinery has had little to do with the depression of that kind of labour. Mr. Kingan, of Glasgow, when asked before the Hand-loom Weavers' Committee if the power-loom had caused the depression of wages, replied, "Not in Scotland: I do not think it has had much effect there, for one reason alone; the article which the power-loom manufacturer

made, was not made by the hand in Scotland when it was erected; it was a new description of goods that was made by power, thick and heavy goods, cambrics and printing cloths, all of which were brought from Lancashire."* Mr. Makin, of Bolton, said to the same Committee—"I conceive, that if the power-loom had not been in existence at all, the same result which has now ensued would have happened, or nearly so."† Still, I cannot doubt that the power-loom has at least contributed to depress the wages of plain weavers, with whose productions it comes in competition; and, by driving some hands from plain to fancy weaving, it must have also caused the other branches to be surcharged with labourers. The rapid multiplication of power-looms is an infallible proof of their superior advantages. Some descriptions of fine goods, as cambrics and muslins, have also been woven by them, though not extensively; and, it is more than probable that they will soon be applied to the weaving of many kinds of fancy goods, for which they are not now calculated. Mechanical ingenuity is an overmatch for unassisted industry. The workmen who adhere to the old processes will, in spite of every effort, be driven into indigence, whilst those who adopt the new are living in comfort and abundance.

The weavers themselves generally ascribe their low wages to the power and disposition of the masters to reduce them, whilst the men, scattered in their distant habitations, are not able to make the same resistance by combinations as the factory operatives. Probably there is some truth in this opinion. Under ordinary circum-

* Report, Q. 183, 512. † Ibid. Q. 4900.

the discussions in their unions, combinations, and clubs, stimulate and sharpen the intellects of the working classes in towns; whilst the solitary labourer in husbandry too often grows up in stupid ignorance and inertness. Yet there are too many proofs of want of information among the working classes in towns, and of their liability to delusion; and every one acquainted with these classes must acknowledge the necessity of a better system of education, by which not merely the elements of knowledge, but the principles which govern social relationships, and the higher principles of morals and religion, should be taught to the whole population.

In the foregoing remarks on the physical and moral condition of the operatives working in mills and at the hand-loom, I am not conscious of having been swayed by prejudice or partiality. I wish not to conceal evils which really exist, but rather to expose them in order to recommend their removal. I am equally indisposed to exaggerate those evils, because this would be unjust, and would rather frustrate than promote the application of suitable remedies. Much prejudice and ignorance exist on these subjects. It is my wish and duty, regardless of that prejudice, to establish the truth; and with this view I have examined all the evidence within my reach, and have given it the weight to which it seemed entitled. I may add, that whilst my opportunities of observation have been good, I have neither interest nor connexion to bias my judgment.

CHAPTER XVII.

Critical period at which the Cotton Manufacture arose in England.—Vast exportations of cottons.—National importance of the manufacture.—Inquiry whether England is likely to maintain her superiority in the manufacture.—Some advantages possessed over her by other countries: greatly overbalanced by the pre-eminent advantages of England, which remain unimpaired.—No symptom of a decline, but the reverse.—Disadvantages of other countries where the manufacture exists, compared with England.—The cotton manufacture of the United States: advantages and disadvantages of the Americans: they can compete with England only in plain and heavy goods.—Progress and extent of the American manufacture.—The cotton manufacture of France: great natural and political disadvantages of that country: alarm of the French spinners and manufacturers at the proposition to admit English goods under any rate of duty.—Slight and partial relaxation of the French tariff.—Statements shewing the comparative cost of cotton spinning and manufacturing in France and England.—French manufacture of bobbin-net.—Estimates of the value and extent of the cotton manufacture in France; population engaged in it; their wages: imports of cotton-wool; exports of cotton goods.—The cotton manufacture of Switzerland; of Belgium; of Prussia, Austria, Saxony, and Lombardy; of Hindoostan.—Inquiry into the policy of allowing the exportation of cotton yarn: reasons against it; answered: the exportation shewn to be desirable.—Concluding remarks on the cotton manufacture, as a source of prosperity to England, and as a main support of her universal commerce; the moral advantages which that commerce may be the means of imparting to other nations.

THE Cotton Manufacture arose in this country at a critical period of our history. England had just lost her American colonies; but that loss was more than compensated by this new source of prosperity springing up at home. The genius of our mechanics repaired the errors of our statesmen. In the long and fearful struggle which followed the French revolution, this country was mainly supported by its commerce; and the largest though the newest branch of that commerce was furnished by the cotton manufacture. To Arkwright and

Watt, England is far more indebted for her triumphs than to Nelson and Wellington. Without the means supplied by her flourishing manufactures and trade, the country could not have borne up under a conflict so prolonged and exhausting.

In the article of cottons alone, the exports amounted, between 1793 and 1815, to £250,000,000.* From 1816 to 1833 inclusive, the declared value of the cotton exports was £306,167,518. Within the last half century, cottons to the enormous value of £570,000,000 have been sent from this country to foreign markets. It is obvious that a trade of this magnitude must have contributed largely to sustain the revenue, to prevent the national resources from being intolerably oppressed by taxation, and therefore to uphold the power and guard the tranquillity of the state.

The question has been much canvassed, whether England is likely to maintain the superiority she has gained among the nations of the world, in regard to the cotton manufacture. There are those who prognosticate that she has already reached the highest point, and is destined rapidly to decline from it. These individuals apprehend a competition too formidable to be withstood, on the part of several foreign nations:—from the United States of America, where the spinning machinery is equal to that of England, where there are thousands of English workmen, where ingenuity and enterprise eminently mark the national character, and where the finest cotton is grown within the States themselves;—from Belgium, Switzerland, and other countries of

* The official value of the cotton exports from 1793 to 1815 was £225,951,139; but the real value (of which the records have been destroyed) would at that time exceed the official value, and may be fairly estimated at £250,000,000.

Europe, where the manufacture exists, and is rapidly extending, and where labour is lower-priced than in England;—and from the East Indies, where one or two spinning mills have been established, and where, in weaving, if not in spinning, the natives are supposed to have a great advantage, from their having so long been habituated to the employment, and from the excessively low rate of wages they require.

It is true that each of these countries has, in some respects, an advantage over England. It is true that the cotton manufacture has acquired a great extent in the United States, and is advancing rapidly in Germany and Switzerland. These facts ought to induce our legislature to repeal the duties on the raw materials of the manufacture,—to place the English manufacturer more on a level with his foreign competitors in the article of food, which forms the chief element in the price of labour,—to remove every restriction that prevents the widest possible extension of English commerce,—and to avoid any measure that would burden or fetter our manufacturers, in their race of competition with foreign nations. There is ample ground for the exercise of precaution. It would be infatuation to trifle with the safety of a manufacture which affords subsistence to a million and a half of our population.

Yet we see no ground for apprehending that England will lose her present manufacturing pre-eminence. All the natural and political causes which originally made this a great manufacturing and commercial nation, remain unimpaired. The exhaustless beds of coal and iron-stone, the abundance of streams with an available fall of water, the inland navigation and well-situated seaports, the national tranquillity, the security for person

and property, the maritime superiority,—all these advantages, in the happiest combination, contribute to place England at the head of manufacturing countries. There is no decay in the energy of the national character; the national institutions are becoming more pure and popular.

There are also advantages derived from the established ascendancy of our manufactures, the importance of which it would be difficult to over-estimate. "Our master manufacturers, engineers, and artisans are more intelligent, skilful, and enterprising than those of any other country; and the extraordinary inventions they have already made, and their familiarity with all the principles and details of the business, will not only enable them to perfect the processes already in use, but can hardly fail to lead to the discovery of others. Our establishments for spinning, weaving, printing, bleaching, &c. are infinitely more complete and perfect than any that exist elsewhere; the division of labour in them is carried to an incomparably greater extent; the workmen are trained from infancy to industrious habits, and have attained that peculiar dexterity and sleight of hand in the performance of their separate tasks, that can only be acquired by long and unremitting application to the same employment."*

Another advantage consists in the almost unlimited amount of capital at the disposal of the English manufacturer and merchant, each of whom is enabled to make his purchases on the best terms, to effect every improvement in his machinery or modes of doing business, to push his enterprises with the utmost vigour, to sell for

* Mr. M'Culloch on the Cotton Manufacture; Edinburgh Review, No. 91.

the smallest proportional profit, and to wait the longest time for his return.

The usual rate of profit in England is lower than in any of the countries whose competition has been feared; and on this account, English manufactures can be sold cheaper than those of other countries; especially owing to the extensive employment of machinery, which causes the price of the goods to be regulated more according to the profits of capital, than according to the wages of labour. Since the introduction of the power-loom, the maintenance of English superiority is rendered much more secure. This country excels every other in the making of machines, and in the means of working them advantageously; and besides this, for the reason just mentioned, our manufacturers are interested in having their goods produced as much as possible by machinery. The power-loom changes the mode of manufacture, from that in which we labour under a considerable disadvantage, to that in which we possess the greatest superiority.

No symptom has yet appeared, to indicate a decline, or even a stagnation, in the cotton manufacture of England. Every year, with scarcely an exception, presents an increase in the raw material imported, and the manufactured goods exported. The course of mechanical and chemical improvement is not stopped. New markets are opening to the enterprise of our merchants, who are ever ready to supply them.

With so many natural and acquired advantages, which in their combination are altogether unrivalled, and with an entire absence of any symptom of declension, there is good reason for believing that the cotton manufacture of this country will continue to flourish;

and, if it does not, as in the nature of things is impossible, still advance with the same giant strides as in the period that immediately followed the great mechanical inventions, we yet feel a confident expectation that its course will be *steadily onward*.

In each of the countries mentioned as likely to compete successfully with England, there are circumstances unfavourable to such competition. In the United States, the high rate of profit, the expensiveness of machinery, and a rate of wages higher even than in England, will for a long course of years prevent the manufacturer from selling his goods so cheap as the English manufacturer; whilst the advantage of having the raw material produced within the boundaries of the republic is small, seeing that the cotton is not grown within many hundred miles of the manufacturing states.

The freight of cotton from New Orleans is half as much to Providence or Boston as it is to Liverpool, and the difference between the two is little more than ¼d. per lb. Add the amount of duty in England, 5-16ths of a penny per lb.; and the total difference to the disadvantage of the English manufacturer will be ⅝ths of a penny per lb. The American has a further advantage in his great command of water-power, which is cheaper than steam-power: it has been calculated by an American cotton manufacturer,* who gave evidence before the Committee of our House of Commons on Manufactures, &c. that the cost of twelve horse-power would be only £3. 10s. in America, whilst it would be £12. 10s. in England,—the former being water-power, and the latter steam-power. The cost of weaving is also less in the United States, because there a girl attends four power-

* Mr. James Kempton: Report on Manufactures, Commerce, &c. p. 167

looms, whereas in England a girl only attends two.* Further, the flour used for dressing the yarn is cheaper there than here. But the American labours under several disadvantages, which counterbalance these advantages: 1st. He pays higher wages: the average wages in the cotton mills of England are 10s. 6d.; in America they are 14s. 11d.† 2d. His machinery is much dearer: a carding engine costs from £40 to £50 in America, which would cost only from £30 to £40 in England; throstles cost from £1. 4s. to £1. 6s., per spindle in America, which are only 8s. to 9s. in England; mules cost from 13s. to 14s. per spindle in America, which are not more than 4s. 6d. to 5s. in England; dressing machines cost from £80 to £90 in America, which in England cost only from £30 to £35; looms cost from £12 to £16 in America, and not more than £7. 10s. to £8. 10s. in England.‡ 3d. The interest of money and the profits of capital are considerably higher in the United States than in this country, which, of course, makes the price of goods higher. 4th. Owing to the climate, the raw material goes further in England, where some of the waste cotton can be spun; whereas the American manufacturer only puts good cotton into his yarn. On the whole, it may be said that the Americans are capable of rivalling the English in coarse and stout manufactures, in which large quantities of the raw material are used, especially in an article called "domestics," which they consume largely, and export to

* Mr. Jas. Kempton; Report on Manufactures, Commerce, &c. p. 167. Mr. Kempton ascribes this curious fact in part to the better machinery, which, he says, the Americans have for weaving coarse goods.

† Papers laid before Congress, 15th February, 1833.

‡ Evidence of Mr. Kempton, Report on Manufactures, &c. p. 150.

some extent; but that in all other kinds of goods, in all which require either fine spinning or hand-loom weaving, the English possess, and must long continue to possess, a very great superiority. In the words of the witness already quoted—"the Americans cannot economically produce fine manufactures; in making fine yarn, they lay aside all their advantages, and have to take up all their disadvantages."* It is even stated, that the American "domestics" are now imitated at Manchester at a cheaper rate.† Our manufacturers have therefore little to fear from American competition.

The growth of the cotton manufacture in America has been rapid. The first cotton mill was erected in Rhode Island in 1791, but as late as 1807 there were not in the Union more than 15 mills, producing about 300,000 lbs. of yarn in a year. The embargo of 1808, the differences with England, and, above all, the war, gave a great stimulus to the manufacturing interest, and led the Americans to indulge the desire of supplying themselves with the cottons and woollens their population required. High protecting duties were therefore established, which forced the growth of manufactures. In 1810, the number of cotton mills had increased to 102, and in 1831 to 795. The quantity of cotton worked in the United States was 500 bales in the year 1800; 1000 bales in 1805; 10,000 bales in 1810; 90,000 bales (or 27,000,000 lbs.) in 1815; and 77,557,316 lbs. in 1831. The exports of American cotton manufactures are inconsiderable, and do not seem to be on the increase: in 1829

* Evidence of Mr. Kempton, Report on Manufactures, &c. p. 169.

† Evidence of Mr. Joshua Bates before the Committee on Manufactures, &c. p. 57.

they amounted to 1,259,457 dollars; in 1830 to 1,318,183 dollars; and in 1832 to 1,229,574 dollars. Of the latter amount, the printed or coloured cottons were 104,870 dollars, white cottons 1,052,891 dollars, and other kinds 71,813 dollars.

The following particulars as to the extent of the manufacture in 1831 are drawn from the Report of a Committee of Congress in 1832, and founded on returns carefully obtained from the different states:—

In twelve states there are	mills	795
. . . .	spindles	1,246,503
. . . .	looms	33,506

The weight of cotton consumed	77,557,316 lbs.
Allowing 2 oz. per lb. for loss	9,694,664
Total weight of yarn produced	67,862,652
Weekly amount	1,305,051

Averaging 16¾ oz. per spindle weekly.

If the 33,506 looms were employed, and the whole 1,305,051 lbs. of yarn manufactured, each loom must have consumed at an average 39 lbs. weekly, shewing that the goods manufactured were of a very heavy description. It also appears from statements made by the same Committee, that

The number of males employed was . .	18,539
. . . females	38,927
Total number emnloyed in spinning and manufacturing	57,466

The amount paid for wages in the year was 10,294,444 dollars, or £2,144,780, being £42,895 per week; averaging 14s. 11d. for each person employed.

They state that the consumption of flour in their manufacture was 1,641,253 lbs. or 8,374 barrels, (196 lbs. each,) averaging weekly 31,562 lbs., or nearly 1 lb. for each loom.

The capital invested in buildings and machinery in the cotton manufacture was £8,461,476 sterling, and the Committee thought that to this sum, returned by the manufacturers, an addition of from one-fourth to one-third might be made.

By the new American tariff, foreign cottons pay an *ad valorem* duty, which averages 40¼ per cent. at present, but will be gradually reduced, so as to be only 20 per cent. on the 30th June, 1842.

If the English cotton manufacture is in little danger from that of the United States, it is certainly not in greater peril from the same manufacture in France. The French consume a somewhat larger quantity of cotton-wool than the Americans, and are indeed second only to England, though their production is only about one-fourth that of the English. In the silk manufacture the French are unequalled, though our own country is pressing hard upon them in this respect: they are pre-eminent in taste and fancy, possess much ingenuity, and rank very high in chemical knowledge. But they labour under such serious disadvantages for conducting manufactures on the large scale, that there is not the least prospect of their ever successfully competing with this country in the manufacture of cotton.

1st. The national character and habits of the French are unfavourable. Though they have an abundance of energy, they lack that close attention and persevering application, which are indispensable to the attainment of the highest skill, and to regularity of operations in an extensive manufactory. The weavers, and even many of the spinners, cannot be induced to work the year round at their looms or mules, but in the months of summer and vintage turn to agricultural pursuits for

relaxation;—a practice which, however agreeable and healthful, is incompatible with high proficiency in any manual art, and most seriously interrupts the operations of the manufactory. It is the combination of perseverance with activity and intelligence, that makes the English artisan unrivalled.*

2d. The political state of France is unfavourable. Wars, invasions, and revolutions, and the liability to their recurrence, have shaken credit, and prevented the manufacturing establishments from gaining that duration and firmness which are needful to the perfection of their arrangements, and to the full development of mercantile enterprise.

3d. France has natural disadvantages, especially in the comparative scarcity of fuel and iron. Coal is not largely found in that country, nor is it raised without considerable expense, and the supply of wood is inadequate to the wants of the manufacturer: the manufacturers of Paris use the coal brought from Mons, but it costs them ten times the price given for that article at Manchester.† Iron is also far from abundant, and is therefore dear.

4th. The artificial state into which French manufacturing industry has been brought, from being propped up on every side with protections, and therefore incapable of free movement, greatly aggravates the natural disadvantages of the country. Coal and iron

* M. Roman, delegate from Alsace to the Commission of Inquiry, who has travelled in England to inspect our manufactures, said, with much justice—"Il y a, dans l'ouvrier Anglais, un espéce de croisement du caractère Français et du caractère Allemand, un melange de Saxon et de Normand, qui lui donne, en même temps, l'attention et la vivacité."

† Evidence of M. Sanson Davillier, of Paris, before the Commission of Inquiry instituted by the French government in the latter part of the year 1834.

might be imported far more cheaply than they can be raised in France, but duties nearly prohibitory are levied upon those articles when imported, to protect the domestic iron and coal proprietors. Of course, these duties fall directly upon machinery, which is in consequence double the price in France that it is in England. The *protection* of the proprietors of iron and coal mines renders it necessary to *protect* the makers of machinery; and the protection of the latter renders it indispensable to protect the cotton manufacturer. The system is a grand series of blunders, and all its parts must stand or fall together. So long as they stand, the body of the French nation will pay for it dearly, in the high price of their cotton and other goods; and if it should fall, their manufacturers will atone for an unfair monopoly by extensive ruin. The manufacturers have been seduced by absurd legislation into a false and dangerous position, where they enjoy no real advantage, and from whence they have no retreat. They have the monopoly of the home market and of the French colonies, except in so far as the smuggler disturbs them; but they hold it under perpetual alarm, and on conditions which prevent them from ever enjoying an export trade of any moment.

5th. As an effect of the political and natural causes already mentioned, the manufacturing establishments in France are small: they are scattered in many parts of the country, in order to supply the wants of the inhabitants; and each spinner and manufacturer is obliged to make a variety of articles, to suit his customers. It is a necessary consequence of this state of things, that the attention both of the manufacturer and of his workmen is divided among several kinds of work, and they are prevented from acquiring excellence in any; whereas

the concentration of the manufacturers in England, and the extent of their market, enables each to confine himself to one or to a few articles, which he brings to the highest perfection, as well as makes with the greatest economy of time and money.

6th. The defective roads and inland navigation of France render the carriage of raw materials and goods expensive.

7th. The duty on the importation of the raw material is 2 per cent. more in France than in England.

8th. Capital is much less plentiful in France, and fetches a higher interest.

These, with other minor causes, place the French cotton spinner and manufacturer in so disadvantageous a position, when compared with the English, as to forbid all prospect of successful competition. In the investigation now pending, before a Commission of Inquiry appointed by the French minister, every witness in the cotton trade hitherto examined has declared that their trade would be ruined in all its departments, if English cottons were admitted, even under a high duty. The delegates from the Chambers of Commerce of Rouen, St. Quentin, Lille, Alsace, Troyes, Amiens, Calais, and many other seats of the cotton manufacture, represent their constituents as feeling the utmost alarm at the proposition to remove the prohibition on foreign manufactures established by the law of February, 1816, which they declare to be their "charter of industry," and their "tutelary ægis."*

The French cotton manufacture was established under the continental system of Napoleon, and in 1810 it consumed 25,000,000 lbs. of cotton-wool. At the peace

* Evidence of M. Lemarchand, of Rouen.

it seemed in danger of utter extinction, from the influx of the cheaper cottons of England; and, to avoid this event, which would have been attended with great though only temporary distress, the government took the course of re-establishing and making permanent the prohibitory system. Under that system the trade continued till the present year, when a very slight and partial relaxation was made.

By an alteration in the tariff made by a royal ordonnance, dated 8th July, 1834, cotton yarns of the high numbers, namely, those above No. 142 French, which answers to No. 189 English, were admitted on payment of a duty of 7 francs per kilogramme, or about 2s. 7¾d. per lb., which is a duty of from 27 to 33 per cent. ad valorem on the qualities chiefly used. It is declared by several French spinners that the introduction of English yarns, consequent on this law, has put an end to the spinning of those yarns in France. The admission will be favourable to the manufacturers of lace and muslins, but injurious to the spinners. The fine English yarns were, however, extensively introduced before by the smuggler.*

* The relaxation in the French tariff was obtained by the able representations of Mr. George Villiers and Dr. Bowring, the English commissioners at Paris, acting under the instructions of Mr. Poulett Thomson, then the Vice-President of the Board of Trade, who used great exertions to obtain a freer commercial intercourse between England and France. The following passages from the "First Report on the Commercial Relations between France and Great Britain," by Messrs. Villiers and Bowring, throw some light on the comparative state of cotton spinning in the two countries:—"Of English manufactures, cotton twist is among those whose fraudulent introduction into France is the most extensive and irrepressible. It makes its way both by land and sea, in spite of all interdictions, to a continually increasing amount. The qualities principally in demand are the higher numbers, which the French mills cannot produce, or produce only at an extravagant price. An official return states, that the French No. 180, which can be bought in England at fr. 18 per kilogramme, sells in France at from fr. 39 to

It is stated, in the reply of the Chamber of Commerce at Lyons to the circular of the Minister of Commerce, that English cotton yarns are from 45 to 75 per cent. cheaper than French. M. Lemarchand, of Rouen, stated that a protecting duty of 40 per cent. ad valorem on English yarns would not save the French spinners from being ruined by their admission; and M. Mimerel, delegate from Lille, Roubaix, and Turcoing, M. Roman, from the departments of Alsace, and several other spinners, gave evidence to the same purport.

M. Mimerel gave in calculations, to shew the comparative cost of producing 2000 kilogrammes of yarn No. 100 (French) by 800 spindles, in France and in England. He estimates that—

fr. 40. The same quality of French manufacture, to which no risk of seizure attaches, will, it is said, produce fr. 42—the 2 or 3 fr. of difference being paid for the additional security. The numbers principally introduced are from 170 to 200, and are employed chiefly for the fabrication of bobbinet (tulle). But there is also a large demand for English cotton chains at Tarare; and they are so necessary for the existence of that manufacture, that, by the connivance of the Custom-house authorities, no seizures take place after the article is lodged in the warehouse of the manufacturer. He has thus to support an additional cost of from 30 to 40 per cent., the whole of which, by the connivance of the government, goes to the contraband traders. The amount of illicit introduction is calculated at above fr. 12,000,000. There is also a large introduction of English tulle (bobbinet), estimated at more than fr. 15,000,000; which sells at from 7 to 8 per cent. above the price of French of the same nominal quality." (p. 48.) It is supposed that the quantity of English manufactures smuggled annually into France is not less than from £2,000,000 to £2,500,000 sterling; of which about five-sixths are cottons and bobbin-net. (p. 52.)

	In England.	In France.
Cotton-wool costs per lb.	2 fr.	2 fr. 40 c.
Duty on 2000 kil. of cotton-wool is .	14,000 —	44,000 fr.
A horse-power of steam costs . . .	240 —	720 —
Machinery, costing twice as much in France as in England, its annual depreciation is twice as great . . .	800 —	1,600 —
Cost of spinning machines per spindle .	20 —	40 —
Repairs of machinery, for 800 spindles	200 —	400 —
Cost of lighting	50 —	160 —
Capital required to produce this quantity of yarn	26,000 —	44,000
Interest of ditto (at 3 per cent. in England, and 5 per cent. in France) . .	780	2,200 —

From all these items he deduces a difference of 28 per cent. against the French; in addition to which, he states that there is the difference in the cost of the workmanship, which is less in England than in France, in proportion to the quantity and quality of the work,—the difference in the general expenses, which are greater in France,—and, after all, the indisputably superior quality of the English yarn.

Another calculation was given by M. Ernest Feray, of the house of Feray and Co., cotton spinners at Essonne and Rouval: it is as follows—

Cost of a Spinning Mill of 25,000 Spindles.

At Essonne.	Francs.	At Manchester.	Francs.
Cost of the first establishment, buildings, and machinery, 800,000 francs; annual depreciation, at 7½ per cent.	60,000	Cost of the first establishment, buildings and machinery, 500,000 francs; annual depreciation, at 7½ per cent.	37,500
Interest of capital, at 5 per cent.	40,000	Interest of capital, at 4 per cent.	20,000
Fuel for the steam-engine, 2¼ loads of Blanzy coal, at 15 fr. per load of 15 hectol. per day, for 300 days	33,750	Fuel for the steam-engine, 2½ loads of Oldham coal, at 6 fr. 50 c. per load of 15 hectol. per day for 300 days	4,875
Fuel for warming the mill	8,000	Fuel for warming the mill	1,200
Lighting with oil, at 115 fr. per 100 kilogrammes	8,000	Lighting with gas, at 5s. per 1000 cubic feet	2,000
To obtain 150 kilog. of yarn, 172,500 kil. of cotton must be used; on which the duty, at 22 francs the 100 kilogrammes, is	37,950	Duty in England, reduced to 3 fr. 50 c. per 100 kilogrammes	6,000
Cost of 172,500 kil. of cotton, at 3 fr. 33 c.—cotton being 10 per cent. dearer at Havre than Liverpool; and adding 1 per cent. for the difference of the expense of carriage to the place of manufacture	571,425	Cost of 172,500 kil. of cotton, at 3 fr. per kil.	517,500
Insurance, at 7 fr. per 1000 fr. on 800,000 fr. (the Companies now demand 10 fr.)	5,600	Insurance, at 5 fr. per 1000 fr. on 500,000 fr.	2,500
Total	787,725	Total	604,075
	604,075		
Difference	183,650		

M. H. Barbet, manufacturer of indiennes at Rouen, gave in an estimate to the Commission, shewing that an establishment, calculated to produce 50,000 pieces of that article in a year, would cost for its outfit 450,000 francs in France, and 270,000 francs in England, and that the annual expenses of the former would be 182,000 francs, and of the latter 74,750 francs. According to M. Sanson Davillier, the delegate of the Chamber of Commerce of Paris, a manufactory of 300 power-looms would cost 610,000 francs to be established at Paris, and only 221,250 francs at Manchester.

The manufacture of bobbin-net in imitation of the Nottingham manufacture, has been carried on for about ten years at Calais and Douai, chiefly with thread smuggled from England; the number of lace-frames is about 1850; but the manufacturers have been conducting a losing trade. According to M. Abiet, lace manufacturer at Douai, English net is 58½ per cent. cheaper than French net; and, as has been seen, very large quantities of the former are introduced by the contraband trade.

In examining the evidence of the French manufacturers, it must not be forgot that their object was to make out a case for the continued prohibition of English cottons, on which account we may reasonably suspect their statements of being coloured, though, perhaps, unintentionally. It is the opinion of Dr. Bowring, whose judgment, from the minute attention he has given to the subject, and from the opportunities he has enjoyed, is entitled to great respect, that the additional cost of French cotton goods above those of England is on the average from 30 to 40 per cent.; that the inferiority of

French machinery is about 25 per cent.; and the inferiority of French labour, that is, the result of the labour of a given number of hands for a given number of hours, is about 20 per cent.

A statement, which may be suspected of exaggeration, was submitted to the French Ministerial Commission by M. Mimerel, as to the extent and value of the French cotton manufacture. The following are the particulars:—

	Francs.
Annual production of cottons in France	600,000,000
Wages and carriage	400,000,000
Raw materials, including cotton-wool, dye-wares, bleaching materials, &c.	110,000,000
Interest of capital	30,000,000
Depreciation of machinery, &c.	15,000,000
Keeping up the machinery, &c.	15,000,000
Profits of producers	30,000,000
	600,000,000

[illegible] of 600,000,000 francs, or £24,000,000 sterling, as the value of the cottons produced annually in France, seems enormous. Equally exaggerated does another estimate of the same witness appear, namely, that the French cotton manufacture employs 800,000 operatives. As the whole import of cotton-wool into that country is only about 80,000,000 lbs., whilst that of England is 300,000,000 lbs., it is evident that the annual value of the goods produced must either have been estimated by us much too low for England, (at from £30,000,000 to £34,000,000,) or by M. Mimerel

much too high for France, (at £24,000,000.) It is, indeed, to be recollected, that French cottons are dearer than English, and that the nominal value of their annual production must therefore be proportionably higher. Still, the estimate here given must be much above the truth. In 1817 the late Count Chaptal stated* that the value of the cotton goods manufactured annually in France was from 200,000,000 to 300,000,000 francs: the extent of the manufacture is much greater now than in 1817, but, owing to the fall in the prices, the money value cannot have very greatly increased.

The estimated number of operatives, 800,000, seems ridiculous, when compared with the number who are estimated to work up almost an equal quantity of cotton in the United States, namely, 57,466. It is to be remembered, however, that the Americans produce scarcely any fine or fancy goods, and print but few of their cloths; they chiefly make a heavy fabric, wrought not by hand, but by the power-loom: whilst in France, on the contrary, every species of fine and fancy manufacture is carried on, as well as printing, and almost all the French weavers work at the hand-loom, and are absent from work for some months in the year.

The estimates given in by the witnesses before the Commission, (who were usually delegated by the local Chambers of Commerce,) as to the number of workmen employed in their respective districts, give some countenance to the statement of M. Mimerel. According to these estimates, the whole number of persons employed in spinning, weaving, printing, bleaching, dyeing, and the other branches, in the principal seats of the cotton manufacture, were as follows:—

* See his Letter in the Encyl. Brit. art. "Cotton Manufacture."

	Number of workmen.
In the arrondissement of Lille, where there are 150 spinning mills	100,000
In Alsace, &c.—including the departments of the Haut and Bas Rhin, Vosges, Haute Saône, and Doubs, in all which there are 56 spinning mills	110,000
In Normandy, &c.—including the departments of Seine-Inferieur, Somme, Pas-de-Calais, l'Aisne, l'Eure, and la Manche	129,170
In the neighbourhood of St. Quentin	75,800
At Amiens	18,000
At Troyes	15,000

These make a total of 447,970;* and they do not include the cotton districts of Paris, Tarrare, Lyons, Nismes, Montpellier, and several others. If the above are at all to be relied upon, there may, perhaps, be nearly 600,000 persons employed in the whole cotton manufacture of France; but the probability seems to be in favour of a lower number.

The wages given to the French workmen, though considerably *lower* per day or per week than those of the English workmen, are really *higher* in proportion to the quantity of labour done. The English workman is better worth the higher rate of wages, than the French workman is worth the lower. This is the general testimony of the French manufacturers. The following are the wages given in three of the principal cotton districts of France:—

* As the sittings of the Commission are not finished, I have not been able to ascertain any further particulars than those above mentioned.

Cotton Districts.	Descriptions of Work-people.		Daily Wages.				
			francs.	cents.		francs.	cents.
At Lille . . .	Spinners	men . . .	3	0			
	—	women . . .	1	20	to	1	25
	Other cotton workers	. . .	1	75	to	2	0
	Do.	Do. . . .	1	0	to	1	25
		children . . .		50	to		60
In Alsace . . .	Spinners	men . . .	1	23	to	3	0
	—	women . . .		75	to	2	0
		children . . .		40	to		50
	Calico weavers	men . . .		60	to	1	25
	—	children . . .		25	to		50
	fine weavers	men . . .	1	25	to	2	50
	printers	men . . .	1	25	to	3	0
	engravers	do. . . .	1	50	to	5	0
	other operatives	do. . . .	1	25	to	1	50
	—	women . . .		90	to	1	50
	—	children . . .		25	to		50
	bleachers	men . . .	1	40	to	1	60
		men . . .	1	50	to	3	0
At St. Quentin	town operatives	women . . .		90	to	1	25
		children . .		50	to	1	25
		men . . .	1	0	to	2	0
	country operatives	women . . .		70	to	1	0
		children . .		30	to		60

The progress of the French manufacture within the last twelve years may be judged of from the following table, extracted from the *Havre Price Current*, corrected and revised by a board of merchants:—

STATEMENT of the Imports of COTTON into France, the Deliveries from the Warehouses, and the Stocks on hand in each Year from 1822.

Years.	Imports.	Deliveries.	Stocks, 31st Dec.
	Bales.	*Bales.*	*Bales.*
1822	205,861	215,199	42,545
1823	169,845	172,312	40,078
1824	251,074	243,958	47,194
1825	203,572	216,460	35,306
1826	320,174	281,001	74,479
1827	290,617	279,693	85,403
1828	206,132	239,723	54,812
1829	242,230	264,750	29,292
1830	282,752	250,784	61,260
1831	218,393	243,843	35,810
1832	259,159	272,463	22,506

By multiplying the bales by 300, (their average weight in lbs.) the above numbers will be reduced into lbs. The quantity imported in 1832 was 77,747,700lbs. and the quantity delivered for consumption 81,738,900lbs.

In the course of the inquiries of the commission, the minister stated that the value of cotton goods exported from France in 1833 was 56,000,000 francs, or £2,240,000 sterling. By far the larger part of these goods is sent to the French colonies. In the year ended 30th September, 1831, French cottons were imported into the United States to the amount of 1,540,732 dollars, or £321,155 sterling.

It would be superfluous to enter into detail concerning the cotton manufacture in the other countries of Europe, seeing that none of them is in the least likely to compete successfully with that of Great Britain. The Swiss manufacture well, and print beautifully; their yarns are 20 per cent. below the French prices, but still they cannot compete with the English, except in the low numbers. The consumption of cotton in 1831 was 56,000 bales, or 18,816,000 lbs. The want of coal,—the limited water-power, already fully occupied,—and the expense of bringing the raw material from Genoa or Trieste,—must always keep down the manufacture in that country.

The Belgian cotton manufacture at Ghent, established during the war, sunk before English competition. The enactment of a protecting system by the government of the United Netherlands, and the monopoly which the Belgian manufacturers enjoyed of the supply of the Dutch colonies, forced up the manufacture to a very flourishing state. But the separation of Holland and Belgium, which has been followed by the loss to the latter of the trade with Dutch colonies, has crushed the manufacture again, and the weavers and spinners are at this moment in a state of the deepest distress.

In Prussia, Austria, Saxony, and Lombardy, this manufacture exists, and is spreading; but in each of these countries it is as yet insignificant. They are all very disadvantageously situated, as regards the supply of the raw material; they are also more liable to be disturbed by wars and political commotions than England; and none of them can pretend to compete with England in this branch of industry.

The Hindoo weaver, low as are his wages, has no chance of competing with the power-loom. The very lowness of the remuneration he obtains, is an evidence of the feebleness and inefficiency of his exertions. It will always be found that the energetic labours of free, intelligent, well-paid, and well-fed workmen, will be cheaper to the employer than the nerveless toil of half-starved slaves and barbarians. The Hindoo weaver, notwithstanding the ancient civilization of his country, is more nearly allied to the latter class than to the former; and the apprehension that he will ever beat out of the market the skilled labour of England, aided by machinery, is altogether visionary. The attempt to work a spinning-mill in Calcutta, with machinery sent from England, has proved an utter failure.

The fear entertained of the competition of other nations, has at different times led the manufacturers to remonstrate loudly against permitting the exportation of English yarn. Our greatest advantage over other nations, they have argued, is in our spinning machinery; foreigners cannot produce yarn comparable to ours; but if they obtain our yarn, they can easily manufacture it into cloth; they therefore buy our yarn, but not our manufactured goods; and thus they deprive England of all that profitable employment for her weavers, which she might otherwise secure. The argument is plausible, and it has again and again been used by the manufacturers of Manchester, Bolton, Stockport, and other places, in applications to parliament to prohibit the exportation of cotton yarn, from the year 1800, about which time yarn was first exported, to the year 1818, and even occasionally to the present day. The names

of the largest manufacturers in Lancashire were attached to such petitions.

It is quite true that several of the continental nations buy large quantities of English yarn, and weave it into cloth. Russia, for example, receives our yarn to the value of £1,087,662 a year, and only imports English cotton manufactures to the value of £142,463. But it does not follow, as is often taken for granted, that if we were to refuse to Russia the produce of our spinners, she would be compelled to take the produce both of our spinners and our weavers. Yarn may be bought in other countries besides England; and though it should be of inferior quality, the same imperial mandate, which now compels the Russians to wear their home-made cotton manufactures dearer or worse than they might be obtained from England, might equally compel them to purchase the yarn of France, Germany, or America, rather than English manufactured goods. The policy recommended by our weavers, therefore, might injure the spinners, without benefiting themselves. That a prohibition to export cotton yarn would operate as a powerful stimulus to the establishment of spinning mills, and to the diligent cultivation of that branch of industry, in other countries, is abundantly evident. That it would provoke other governments altogether to exclude English manufactures, is highly probable. The ultimate result of such a policy would therefore be rather to lessen than to increase the demand for the produce of English labour, and to render other countries far more independent of us than they are at present.

If the exportation of yarn had really diminished the exportation of manufactured goods, there might seem

to be justice in the assertion, that England has lost a source of profitable employment which she might otherwise have enjoyed. But this is not the case. The export of manufactured goods has been constantly on the increase. Not a single weaver, therefore, has been thrown out of employment by the exportation of yarn, though an additional number of spinners has found employment. New capital has been continually invested in the trade. The extension of the manufacture has been sufficiently rapid and great to satisfy any ordinary ambition or cupidity. There is no likelihood that the total value of our cotton exports would have been higher than at present, if the exportation of yarn had been prohibited; but the reverse.

The principle which alone would justify a prohibition of the exportation of yarn, would require that we should export no article except in its last and most finished state—that we should sell to foreigners not plain goods, but dyed and printed cloths; not cottons in the piece, but made up into garments and drapery; not our sheep's wool, but finished woollen and worsted cloth; not iron and steel, but cutlery, tools, and machines; not tools and machines, but the articles they are intended to make. On the same principle, America ought to manufacture all her own cotton, Russia her flax, Saxony her wool, Sweden her iron, Italy her silk; and governments should take upon them to prescribe in what channels capital and industry should flow, from the beginning to the end of their course, instead of leaving that to be decided by the sagacity of individuals, under the sure guidance of self-interest. Such interference would be about as wise as it would be to prop and train every

tree of the forest. If the history of the woollen manufacture, which presents a long series of idle interpositions on the part of the legislature,—each new law proclaiming the inefficiency and folly of those that preceded it—had not been enough to shew the futility of the *meddling* policy,* the history of the cotton manufacture ought at least to have given confidence to all connected with that trade, that the *let-alone* policy was the wisest and best. There is room for the industry of other nations beside our own. We shall not be starved by allowing them to live. The poorest states have generally been those, whose pettifogging legislation has grasped at every advantage, and sponged every foreigner: the richest are those which have given perfect freedom to domestic industry, and unrestricted permission to all the world to buy and sell at their marts.

In concluding this History of the British Cotton Manufacture, the author may be permitted to express

* The history of the woollen manufacture furnishes a case exactly in point, to prove the inutility of attempting to engross every branch of manufacturing industry to ourselves. In the reign of James I. (1608,) a royal proclamation was issued, prohibiting the exportation of woollen cloths in the *white* state; this was expressly intended to deprive the Netherlands of a branch of employment which engaged many hands in that country, namely, the dyeing and finishing of English woollens; and it was expected that our continental customers would then be obliged to obtain the finished cloths from England, which, of course, would bring a great additional amount of employment to our dyers. The result not merely disappointed the greedy expectations which dictated this act, but it distressed our manufacturers, without benefiting our dyers. The foreign demand for English cloths was diminished; *the government of the Netherlands retaliated upon us by prohibiting the importation of* ALL *English woollens;* and the king was obliged in 1615 to acknowledge his folly, by repealing the prohibition he had enacted.

a sentiment he has often felt during its composition, namely, that his subject derives interest not merely from the magnitude of the branch of industry which he has attempted to describe, but from the wonderful extent of intercourse which it has established between this country and every part of the globe;—not merely from the fact, that Manchester, Glasgow, Liverpool, and indeed several large counties of England and Scotland, owe to the cotton manufacture a great proportion of their wealth and populousness, but that the Americas and the East are by the same means united in new and powerful bonds of amity with England;—nor even merely from the contemplation of the rich and mutually advantageous commerce which this manufacture has enabled Englishmen to maintain with all the nations of the world, but from the *moral benefits* which such a commerce, centering in and radiating from a country at the head of civilization, may be the means of spreading to the less enlightened parts of the earth. No nation ever had a more universal commerce than this: no manufacturers ever clothed so many of the human family, as the cotton manufacturers of England. From so extended an intercourse, it may reasonably be anticipated that the minds of our population, as well as their outward circumstances, will be enriched and improved; seeing that it is the natural effect of such intercourse to impart knowledge and to remove prejudice. But it is also their privilege to be enabled to communicate to other nations a share of their own advantages. The civilization of England flies abroad on the wings of its commerce. Philanthropy could not desire a more powerful agent for diffusing light and liberty through

the world. It will be a proud distinction for the manufacturers of England, if their trade should minister to the moral improvement of the human species. To produce such an effect is worthy of their ambition; and, if accomplished, it will be a more honourable achievement than all their triumphs in science and the arts.

THE END.

APPENDIX.

A. *Byssus—Egyptian Manufactures.* Page 16.

There is a passage in Herodotus which has been understood as shewing that the Egyptians manufactured cotton, and used cotton cloth as wrappings for their mummies. In his description of the mode of embalming (book ii. c. 86.), that author says, the body was closely wrapped in bandages of cloth, the quality of which he indicates by the words σινδόνος βύσσινης. These words are rendered by the translators (Larcher and Beloe) "*cotton*:" several other writers have given the same meaning to βύσσος, or *byssus*; yet the meaning of this word is, at best, very doubtful. Isidore (Orig. l. xix. c. 27.) says distinctly that it was an exceedingly white and soft kind of *flax*. Julius Pollux (lib. vii. 12.) says that it denotes the finest *flax*, *cotton*, and the silky beard of the *pinna marina*. Pausanias states (*In Eliacis* l. 1.) that *byssus* grew in Egypt, Judea, India, and Elis; which is true of flax, but cotton certainly did not at that time grow in any part of Greece. There has been much controversy on this word, and it has even been doubted whether *byssus* belonged to the vegetable, animal, or mineral kingdom. In all probability Herodotus, by σινδόνος βυσσινης, meant linen made of a fine and peculiar kind of flax, or a cloth of delicate texture, without reference to the material of which it was made. That βύσσος meant *cotton* is rendered highly improbable by the fact, that no mummy-coverings have yet been found which are made of this material, but all of linen.

I had intended to discuss this question more at length, but am spared that labour by the successful investigations of Mr. Thomson, of Clitheroe, who has lately set at rest this *vexata questio*, by a discovery which reduces a great deal of the learning that has been expended upon it to the character of old lumber. The difficulty of ascertaining whether the mummy-cloths (of which the specimens are exceedingly numerous) were made of linen or cotton, has at length been overcome; and though no chemical test could be found out to settle

the question, it has been decided by that important aid to scientific scrutiny, the *microscope*. Mr. Thomson's discovery was embodied in a paper read by him last year to the Royal Society. I have been favoured with his permission to transfer the whole to my work, and he has also kindly presented me with the interesting engraving which accompanied it. The paper contains so much curious and valuable information that it will be read with interest:—

"*On the Mummy Cloth of Egypt; with Observations on some Manufactures of the Ancients.* By JAMES THOMSON, *Esq.*, *F.R.S.*

"THE inquiries which form the subject of the following paper were undertaken many years ago: circumstances which it is unnecessary here to explain, have delayed their publication; but the results were communicated to numerous individuals. The revival lately of similar inquiries by others apparently unacquainted with what is already known, induces me to believe that this communication may not be wholly without interest.

"My attention was attracted to the subject of Egyptian manufactures by the late Mr. Belzoni in the year 1822, during the exhibition of a model of the ancient tomb discovered by that enterprising traveller in Egypt. He had the goodness to present to me various specimens of cloth, chiefly from the mummies in his possession, one of which he had entirely denuded.

"On my remarking that these fabrics scarcely deserved the appellation of "fine linen," which from all antiquity had been bestowed on the linen of Egypt, and that the observations of Dr. Hadley, in the Philosophical Transactions for the year 1764, had thrown some doubt on the supposed fineness of this linen, he informed me that during his researches in Egypt, in those tombs and mummy-pits which he had explored, he had met with cloth of every degree of fineness, from the coarsest sacking to the finest and most transparent muslin, a fact which I subsequently found in a great degree confirmed by the acquisition of some interesting specimens of mummy cloth sent to this country by the then Consul-general of Egypt, the late Mr. Salt. The subject appearing to me sufficiently interesting to deserve investigation, and having collected a variety of specimens of cloth, my first care was to ascertain of what material they were made. This question had already engaged the attention of various inquirers, and given birth to learned dissertations.

"Rouelle, in the Memoirs of the French Academy of Sciences for the year 1750; Larcher, the translator of Herodotus, in the notes to that

celebrated work; and the learned John Reinhold Forster, who wrote a tract *De Bysso Antiquorum*, had all endeavoured to prove from their own examination that the mummy cloth of Egypt was cotton: and this opinion, on their authority, was adopted by the learned of Europe. It is singular that neither in the memoir of Rouelle, nor in the notes of Larcher, nor in the dissertation of Dr. Forster, in which this opinion is expressed, are any grounds assigned for, or any proofs given of, this opinion. The amount of their assertion is, that having examined the bandages of various mummies, which are designated by them, and some of which I have myself since carefully examined, they found all those which were free from resinous matter to be cotton. I am forced to confess, that with all the attention I could bestow upon them, and with the assistance of various intelligent manufacturers, I was unable to arrive at such a conclusion. Some were of opinion that the cloth was cotton; others that it was linen; and some again, that there were in the collection specimens of both,—a proof that our means of judging were unworthy of confidence.

"The great difference in the specific gravities as well as in the conducting power of linen and cotton, is sufficient to enable us, by careful experiments, to discriminate accurately between them; and there are few individuals who have been accustomed to the use of both cotton and linen who cannot readily distinguish, by that delicate sense of touch diffused over the whole body, between the two fabrics: but such tests require much larger portions of the material than I had at my disposal, many of the specimens submitted to my examination not being larger than a shilling. I found the difference of smell in the burnt fibres, and the degree of polish which each kind of cloth took on being rubbed with a glass stopper, as well as other empirical modes suggested to me, liable to great uncertainty, and I sought in vain for any chemical test. It occurred to me, that the supposed unfitness of cotton lint, compared with linen, for dressing wounds had been accounted for by the different form of their fibres, the one being sharp and angular, and the other round and smooth; and, in fact, I found in the 12th volume of the Philosophical Transactions, for the year 1678, this structure ascribed to them by that early microscopic observer, Mr. Leuwenhoek. It seemed to me, therefore, that the most simple mode of distinguishing between cotton and linen would be to subject the fibres to examination under a powerful microscope. Not being possessed of such an instrument, nor accustomed to its management, my friend Mr. Children undertook, through Sir Everard Home, to solicit the assistance of Mr. Bauer, whose labours are well known to the scientific world, and whose microscopic drawings have for a series of years enriched the Transactions of the Royal Society. I transmitted to him various fibres of cotton and linen, both manufactured

and in their raw state, as well as fibres of unravelled mummy cloth, and in a few days I received from him a letter, in which he pronounced every specimen of mummy cloth subjected to his examination to be linen.

"This letter was accompanied by a beautiful drawing, exhibiting the fibres of both raw and unravelled cotton as flattened cylinders, twisted like a corkscrew, whilst the fibres of linen and various mummy cloths were straight and cylindrical.

"Repeated observations having established beyond all doubt the power of the microscope accurately to distinguish between the fibres of cotton and linen, I obtained, through the kindness of various individuals connected with the British Museum, the Royal College of Surgeons, the Hunterian Museum of Glasgow, as well as other public institutions, both at home and abroad, a great variety of cloths of human mummies, and of animals and birds, which being subjected to the microscope of Mr. Bauer, proved without exception to be linen; nor has he, amongst the numerous specimens we have both collected during many years, been able to detect a single fibre of cotton; a fact since recently confirmed by others, and proving incontestably that the mummy cloth of Egypt was linen.

§ II.

"The filaments of cotton, when viewed through a powerful instrument, such as the improved achromatic microscope of Ploessl of Vienna, which for magnifying power and clearness of vision Mr. Bauer has found superior to every other he has had an opportunity of using, appear to be transparent glassy tubes, flattened, and twisted round their own axis. A section of the filament resembles in some degree a figure of 8, the tube originally cylindrical having collapsed most in the middle, forming semi-tubes on each side, which give to the fibre, when viewed in certain lights, the appearance of a flat ribbon with a hem or border at each edge. The uniform transparency of the filament is impaired by small irregular figures, in all probability wrinkles or creases arising from the desiccation of the tube. The twisted and corkscrew form of the filament of cotton distinguishes it from all other vegetable fibres, and is characteristic of the fully ripe and mature pod, Mr. Bauer having ascertained that the fibres of the unripe seed are simple untwisted cylindrical tubes, which never twist afterwards if separated from the plant; but when the seeds ripen, even before the capsule bursts, the cylindrical tubes collapse in the middle, and assume the form already described, and which is accurately delineated in the accompanying drawing.

"This form and character the fibres retain ever after, and in that

respect undergo no change through the operation of spinning, weaving, bleaching, printing, and dyeing, nor in all the subsequent domestic operations of washing, &c., till the stuff is worn to rags; and then even the violent process of reducing those rags to pulp for the purpose of making paper, effects no change in the structure of these fibres. 'With Ploessl's microscope,' says Mr. Bauer, 'I can ascertain whether cotton rags have been mixed with linen in any manufactured paper whatever.'

"The elementary fibres of flax (*linum usitatissimum*) are also transparent tubes, cylindrical, and articulated or jointed like a cane. This latter structure is only observable by the aid of an excellent instrument. They are accurately delineated in the annexed engraving.

Explanation of the Plate.

"First row of figures: A. Fibres of the unripe seed of cotton. In that state the fibres are perfect cylindrical tubes. At * is a fibre represented as seen under water, showing that the water had gradually entered and enclosed several air-bubbles, proving the tube to be quite hollow and without joints.

"B. The first two fibres are from ripe cotton and are already twisted, though the pod or capsule is not yet burst, and is still on the growing plant. The other three fibres are of raw cotton prepared for manufacture.

C. Various fibres of unravelled threads of manufactured cotton. The fibres of cotton in the annexed drawing are represented $\frac{1}{100}$ of an inch in length, and are magnified 400 times in diameter. In thickness these fibres vary from $\frac{1}{800}$ to $\frac{1}{3600}$ part of an inch. The twists or turns in a fibre of cotton are from 300 to 800 in an inch.

"Second row of figures:

"Fig. 1. Fibres of raw flax before spinning.

"Fig. 2. Fibres of unravelled threads of manufactured flax.

"Fig. 3. 4. 5. Fibres of the unravelled threads of various mummy cloths.

"Fig. 6. Fibres of unravelled threads of the cloth of Dr Granville's mummy, supposed to be cotton. The specimens are all flax, and the fibres remarkably strong and large.

"Fig. 7. Fibres of unravelled threads of several Ibis mummies.

"Fig. 8. Fibres of unravelled threads of the mummy of an ox's head.

"All the annexed figures of fibres of flax represent each $\frac{1}{100}$ of an inch in length, and are magnified 400 times in diameter. They vary in thickness from $\frac{1}{800}$ to $\frac{1}{3600}$ part of an inch.

§ III.

"Of the productions of the loom amongst the nations of antiquity, with the exception of those which form the subject of this paper, we know only what is to be gathered from the few scattered notices in ancient writers. Even the great work of Pliny, the encyclopædia of that day, and with all its defects an invaluable collection of facts, affords but scanty information. Of the manufactures of the Egyptians and of their domestic arts our knowledge is more ample, but we are more indebted to their monuments than to their historians; and the paintings which adorn their tombs, and which are fresh at the present day as from the hand of the artist, have revealed to us more than all the writers of antiquity.

"Of the products of the Egyptian loom, however, we know scarcely more than the mummy-pits have disclosed to us; and it would be as unreasonable to look through modern sepulchres for specimens and proofs of the state of manufacturing art amongst ourselves, as to deduce an opinion of the skill of the Egyptians from those fragments of cloth which envelop their dead, and have come down, almost unchanged, to our own time. The curious or costly fabrics which adorned the living, and were the pride of the industry and skill of Thebes, have perished ages ago. There are, however, amongst these remains some which are not unworthy of notice, which carry us back into the workshops of former times, and exhibit to us the actual labours of the weavers and dyers of Egypt more than two thousand years ago.

"The great mass of the mummy cloth employed in bandages and coverings, whether of birds, animals, or of the human species, is of coarse texture, especially that more immediately in contact with the body, and which is generally impregnated with resinous or bituminous matter. The upper bandages, nearer the surface, are finer. Sometimes the whole is enveloped in a covering coarse and thick, and very like the sacking of the present day; sometimes in cloth coarse and open, like that used in our cheese-presses, for which it might easily be mistaken. In the College of Surgeons are various specimens of these cloths, some of which are very curious.

"The beauty of the texture and peculiarity in the structure of a mummy cloth given to me by Mr. Belzoni was very striking. It was free from gum, or resin, or impregnation of any kind, and had evidently been originally white. It was close and firm, yet very elastic. The yarn of both warp and woof was remarkably even and well spun. The thread of the warp was *double*, consisting of two finer threads twisted together. The woof was single. The warp contained 90 threads in an inch; the woof, or weft, only 44. The fineness of these

materials, estimated after the manner of cotton yarn, was about 30 hanks in the pound.

"The subsequent examination of a great variety of mummy cloths showed that the disparity between the warp and woof belonged to the system of manufacture, and that the warp generally had twice or thrice, and not seldom four times, the number of threads in an inch that the woof had: thus, a cloth containing 80 threads of warp in the inch, of a fineness about 24 hanks in the pound, had 40 threads in the woof; another with 120 threads of warp of 30 hanks, had 40; and a third specimen only 30 threads in the woof. These have each respectively, double, treble, and quadruple the number of threads in the warp that they have in the woof. This structure, so different from modern cloth, which has the proportions nearly equal, originated, probably, in the difficulty and tediousness of getting in the woof when the shuttle was thrown by hand, which is the practice in India at the present day, and which there are weavers still living old enough to remember the universal practice in this country.

"I have alluded to some specimens of mummy cloth sent to this country by the late Mr. Salt. I am unacquainted with their history or origin further than that they were brought from Thebes, and were contained in the outer packing-case of a mummy now in the British Museum. They were evidently the spoils of some other mummy, but when and where opened I have in vain endeavoured to learn. There were various fragments of different degrees of fineness; some fringed at the ends, and some striped at the edges. They merit a more particular description.

"My first impression on seeing these cloths was that the finest kinds were *muslin*, and of Indian manufacture, since we learn from the "Periplus of the Erythrean Sea," ascribed to Arrian, but more probably the work of some Greek merchant, himself engaged in the trade, that muslins from the Ganges were an article of export from India to the Arabian Gulf; but this suspicion of their being cotton was soon removed by the microscope of Mr. Bauer, which shewed that they were all, without exception, linen. Some were thin and transparent, and of very delicate texture. The finest appeared to be made of yarns of near 100 hanks in the pound, with 140 threads in the inch in the warp, and about 64 in the woof. A specimen of muslin in the Museum of the East India House, the finest production of the Dacca loom, has only 100 threads in an inch in the warp, and 84 in the woof, but the surprising fineness of the yarns, which, though spun by hand, is not less than 250 hanks in the pound, gives to this fabric its unrivalled tenuity and lightness.

"Some of the cloths were fringed at the ends, and one, a sort of scarf about four feet long and twenty inches wide, was fringed at both ends. Three or four threads twisted together with the fingers to form

a strong one, and two of these again twisted together and knotted at the middle and at the end to prevent unravelling, formed the fringe, precisely like the silk shawls of the present day.

"The selvedges of the Egyptian cloths generally are formed with the greatest care, and are well calculated by their strength to protect the cloth from accident. Fillets of strong cloth or tape also secure the ends of the pieces from injury, shewing a knowledge of all the little resources of modern manufacture. Several of the specimens, both of fine and coarse cloth, were bordered with blue stripes of various patterns, and in some alternating with narrow lines of another colour. The width of the patterns varied from half an inch to an inch and a quarter. In the latter were seven blue stripes, the broadest about half an inch wide nearest the selvedge, followed by five very narrow ones, and terminated by one an eighth of an inch broad. Had this pattern, instead of being confined to the edge of the cloth, been repeated across its whole breadth, it would have formed a modern gingham, which we can scarcely doubt was one of the articles of Egyptian industry. A small pattern about half an inch broad formed the edging of one of the finest of these cloths, and was composed of a stripe of blue, followed by three narrow lines of the same colour, alternating with three lines of a fawn colour, forming a simple and elegant border. These stripes were produced in the loom by coloured threads previously dyed in the yarn. The nature of the fawn colour I was unable to determine. It was too much degraded by age, and the quantity too small, to enable me to arrive at any satisfactory conclusion. Though I had no doubt the colouring matter of the blue stripes was indigo, I subjected the cloth to the following examination. Boiled in water for some time, the colour did not yield in the least; nor was it at all affected by soap, nor by strong alkalies. Sulphuric acid, diluted only so far as not to destroy the cloth, had no action on the colour. Chloride of lime gradually reduced, and at last destroyed it. Strong nitric acid dropped upon the blue turned it orange, and, in the same instant, destroyed it. These tests prove the colouring matter of these stripes to be indigo.

"This dye was unknown to Herodotus, for he makes no mention of it. It was known to Pliny, who, though ignorant of its true nature and the history of its production, has correctly described the most characteristic of its properties, the emission of a beautiful purple vapour when exposed to heat. Had his commentators been acquainted with the sublimation of indigo, it would have saved many learned doubts. We learn from the "Periplus," that it was an article of export from Barbariké on the Indus to Egypt, where its employment by the manufacturers of that country, probably from a remote period, is clearly established by the specimens here described.

"Amongst the various cloths for which I am indebted to the curators of the Hunterian Museum at Glasgow, is one of a pale brick or red colour. My attention was lately recalled to this specimen by observing a similar colour in the outer coverings of two fine mummies presented to the University of London by Mr. Morrison, one of which has been recently unrolled. Having obtained specimens of both, I subjected them, with that from Glasgow, to the following experiments. Treated with cold water, the colour was not affected. Boiling distilled water in a few minutes nearly removed the whole. Diluted sulphuric or muriatic acid had no action on it; but a feeble alkali, whether carbonated or caustic, destroyed the colour immediately. Examined with a lens, the specimens from Glasgow exhibited small distinct grains or concretions, of a red colour, disseminated through the fibres of the cloth. Notwithstanding the fugitive nature of the colouring matter of safflower, the *carthamus tinctorius* of botanists, I am strongly disposed to consider the three specimens here examined as having been dyed with that plant. The small granular particles of a red colour observed in the Glasgow specimen are sometimes found in cloth dyed with *carthamus*. There is also in the covering of the mummy of the London University which is unstripped, a rosy hue peculiar to this dye. The resistance of the colour to acids, and its instant yielding to the weakest alkalies, is characteristic of Safflower. Lastly, *carthamus* has long been an article of cultivation in Egypt, and the first processes employed by the European dyers were derived, with the dye itself, from that country, where in all probability it has been cultivated and used for ages, and is to this day an article of considerable export.

"In the Glasgow mummy there was, moreover, a narrow slip of cloth about four inches broad, extending from the crown of the head to the feet, of a yellowish colour, of which portions were still fresh. On examination, no mordant appeared to have been used to fix this dye, and washing in cold water greatly impaired it. Comparative experiments made on this colour, and on that afforded by *carthamus* to simple water before the pink dye is extracted, left little doubt of their being identical. They were slightly and similarly affected by solutions of alumina and of iron, and appeared to have very feeble affinities for either vegetable fibre or any of the earthy or metallic bases.

"Though the age of the mummies from which these specimens were derived has not been ascertained, yet we may fairly presume that it goes back to a period so far remote as to make the preservation so long of delicate and fugacious colouring matter like *carthamus*, or even the more permanent one of indigo, very surprising, and proves that substances which readily yield to the combined and destructive agency

of heat or light and *moisture*, are almost unalterable when secured from the action of the latter. Portions of the blue cloth which had resisted in the dark and dry sepulchres of Thebes for ages, lost, by a few days' exposure on the grass, nearly all their colour.

"Mummy cloth not stained or discoloured by resin or bitumen is generally of a pale-brown or fawn colour, which has been supposed to arise from some astringent preparation employed by the Egyptians for its preservation. All this cloth imparts to water a brown colour, in which I have sought in vain for any trace of tannin. In none of the specimens I have examined did either gelatine or albumen, or solutions of iron, afford any precipitate; but the subacetate of lead produced a cloud, indicating the presence of extractive matter. I am inclined to think that if astringent matter has been found, it is in those bandages which have received a preparation of gum or resin, and which are distinguished from the others by their stiffness. These I have not examined. All these cloths, whether fine or coarse, are more or less rotten. Of the numerous specimens which have fallen under my notice, the outer covering of the fine mummy in the London University has suffered least: it is comparatively sound. Whether this be an argument against its high antiquity, I know not; but the cloth is evidently ancient Egyptian: nor is it, I believe, pretended that in those factitious mummies manufactured by the Arabs, of which several were found by Blumenbach in the British Museum, the bandages and envelopes are not genuine. Of the ancient cloth there is such an accumulation in the mummy pits and sepulchres of Egypt, as to have become an object of speculation in Europe, for the purpose of making paper. The inquiries, therefore, which form the subject of this communication are not affected by any question of the integrity of those mummies from whence the specimens were derived, of which, however, no doubt is entertained.

"The period during which the custom of embalming prevailed in Egypt, embraces a long succession of ages. From the first of the Pharaohs to the last of the Ptolemies, with whom this ancient rite is supposed to have become almost extinct, chronologists reckon more than twenty centuries during which the art was practised which has handed down to us these scanty remains of Egyptian industry, the only vestiges of the labours of the ancient loom now in existence. They prove the arts of spinning and weaving flax to have attained a high degree of perfection, many of the specimens of mummy cloth here described being of a quality to excite admiration even at the present day, and the finest of these fabrics approaching in excellence our delicate muslins. The coloured borders establish the fact of indigo having been known and used as a dye in Egypt, from a remote æra.

"During this long period, industry and the arts of life connected with civilization must have made considerable progress, which we shall, however, remain unable satisfactorily to trace till more accurate knowledge of the ancient language and characters of the Egyptians shall have interpreted the dates, and fixed the chronology of their monuments and paintings. In the tomb of Beni Hassan is a representation of a loom (figured in Count Minutoli's Travels) of such primæval simplicity as to resemble the first rude efforts of savage art to form a web, such as Don Ulloa in his voyages has described as used by the native Indians of South America. Between this loom, and that in which the corslet of Amasis was woven, mentioned by Herodotus, and more particularly described by Pliny as a wonderful specimen of manufacturing art, the distance is immense.

"It is not improbable that future researches directed to this object may discover, in the ancient sepulchres and mummy pits, fragments of cloth, now trodden under foot and unheeded by the traveller, which would throw much light on the interesting subject of ancient manufactures.

"The question debated amongst the learned, of the nature of the BYSSUS of the ancients, I may in conclusion be permitted to observe, appears to me to be finally settled by the present communication. Herodotus states that the Egyptians wrapped their dead in cloth of the *byssus*. It has been shewn that without exception every specimen of mummy cloth yet examined has proved to be linen. We owe, therefore, the satisfactory establishment of the fact, that the *byssus* of the ancients was FLAX, to the microscope of Mr. Bauer."

NOTE,

Relative to the Form of the Fibres of Cotton.

BY JAMES THOMSON, F.R.S.

In the first volume of the "*Bulletin de la Société Industrielle de Mulhausen*," published in 1828, is a memoir, by Mr. Josué Heilman, entitled "Observations Microscopiques sur la forme, la finesse, et la force des filamens de Coton," in which he ascribes to the fibres of Cotton the same form precisely given to them in the drawing of Mr. Bauer, dated Feb. 11, 1822, which accompanies my paper "On Mummy Cloth."

Mr. Heilman's "Observations" are accompanied by a drawing of Mr. Edward Koecklin, of the fibres of cotton. Whoever will take the trouble to compare the two drawings, will detect internal evidence of the one being derived from the other. Mr. Heilman's paper being published in 1828, and mine in 1834, renders some explanation necessary.

In 1822 or 1823, Mr. Edward Koechlin was in England, and during a visit he paid to me at Primrose, he saw Mr. Bauer's drawing, and requested permission to copy it, which was readily granted. It is from this drawing and Mr. Koechlin's communication, that Mr. Heilman's "Observations Microscopiques" are derived.

The paltry fraud of appropriating to himself the observations of others, without acknowledgment, might have passed unnoticed by me for ever, had not the friends of Mr. Bauer considered this explanation necessary.

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